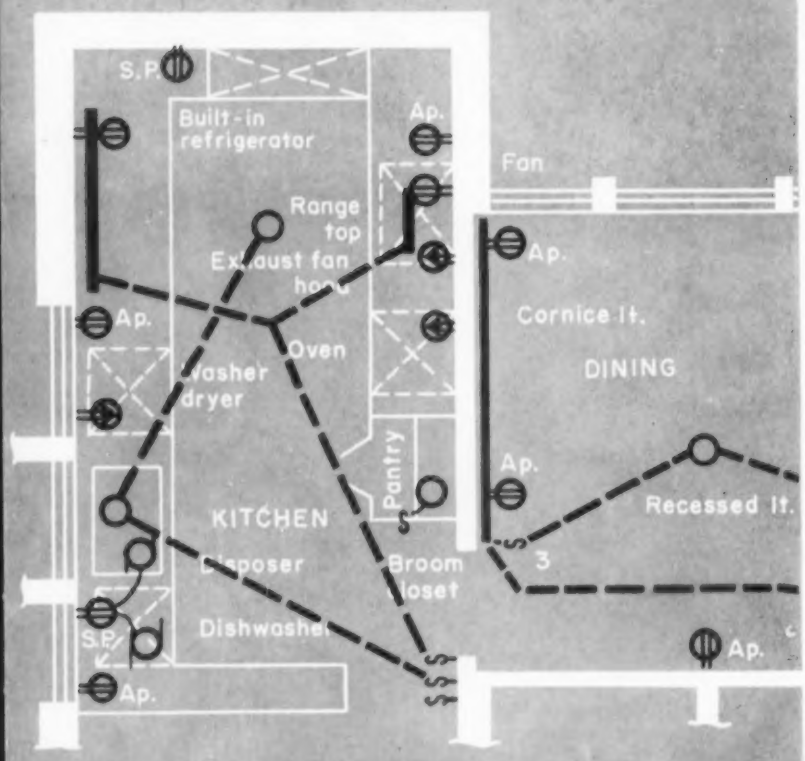
MARCH · 1957
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



High-Capacity RESIDENTIAL WIRING

Current wiring details from modern electric homes.

A special report.

page 85

National Lighting Competition to offer $5400 in prizes.

page 98

Wood pole-line specification and construction details.

page 104

A McGRAW-HILL PUBLICATION 56TH YEAR

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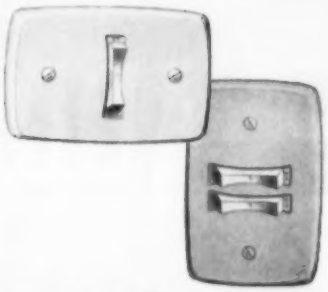
ACCURATE TAPES

FRICTION, RUBBER and PLASTIC

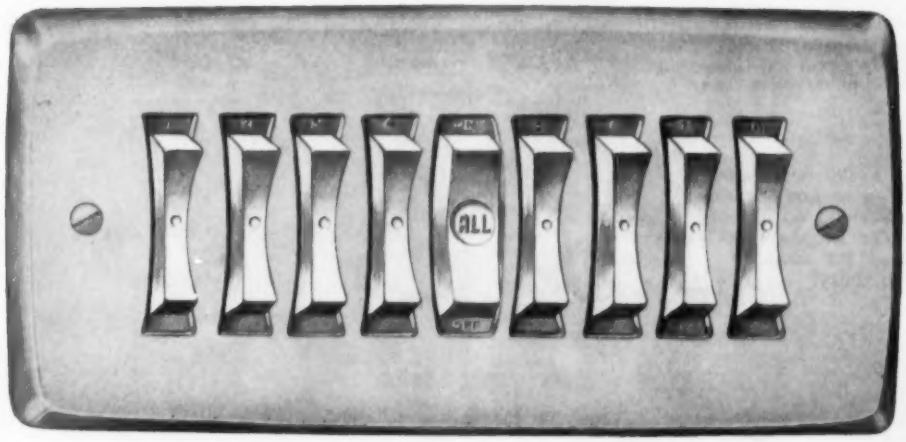
ACCURATE MANUFACTURING COMPANY Garfield, New Jersey



switches your customers want

And no wonder. They're not just remote-control switches, not just low-voltage switches. They're Remcon's dramatic new, Hi-Fashion Switches. Show them to your builder-customers now—and start raking in extra Remcon profit on every wiring job.

REMCON the easiest switch to install... is now the most beautiful switch of all!



master control with one-hand operation

You can control lights in 8 rooms individually or all 8 simultaneously with one switch. Definite on-off positions. Completely fool-proof operation. Color-coded for instant identification of each switch.

complete line of matching switchplates

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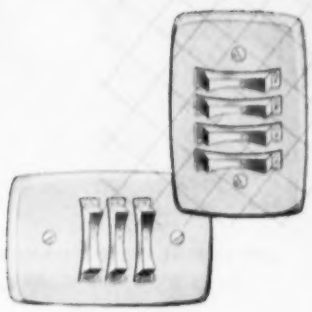
The look of tomorrow on the most modern switch of today. No other switch offers you the handsome contours of the REMCON plate, sweeping down towards the switches . . . or the fashion-engineered "butterfly" design of the REMCON switches themselves. No other switch adds such a gracious note to any decor.

famous, easy, remcon low-voltage installation

REMCON is the only low-voltage system with a transformer built right into the relay. It's the new, modern, simplified wiring method. Now, you have an irresistible combination for your customers—low voltage, remote-control switching with the look of tomorrow—at little more than the cost of ordinary switching!



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SWITCHES

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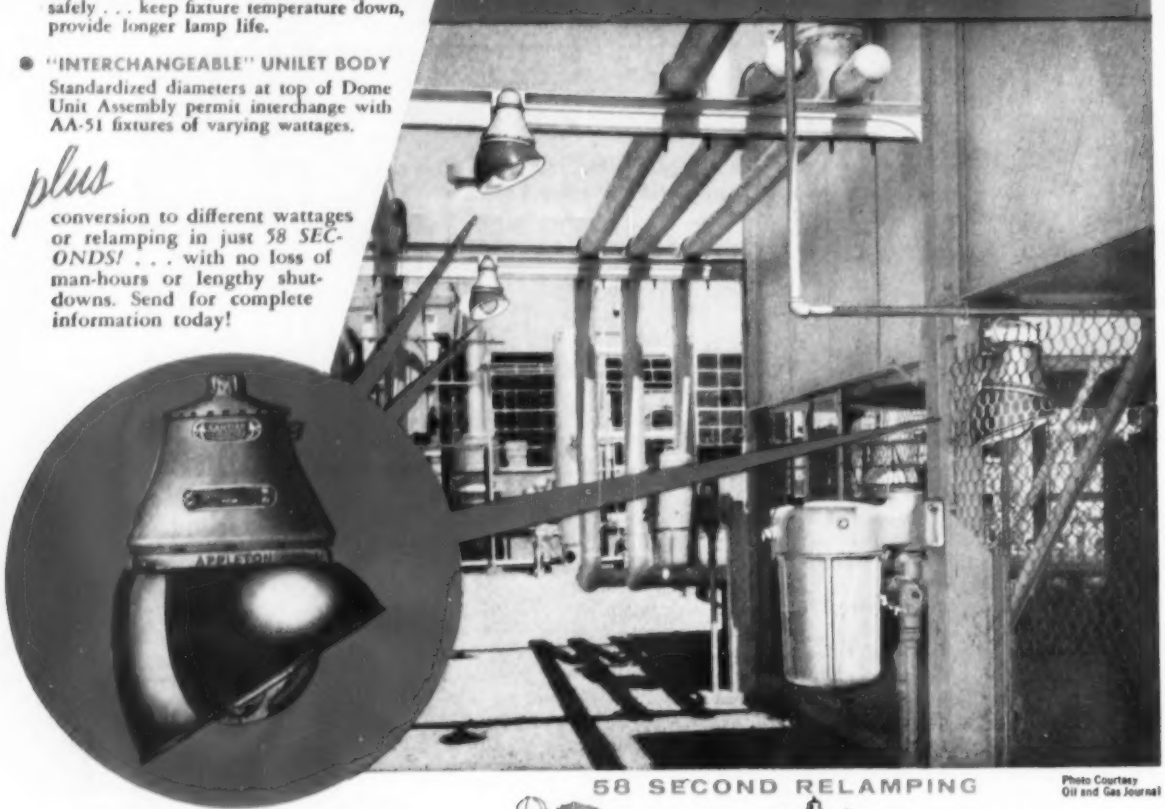
  Exclusive safety chamber prevents explosions even when fixture is serviced with current on! APPLETON *Series AA-51 Vented Explosion-proof Fixtures* offer the positive protection required for hazardous areas.
- **"FULL-CIRCLE" VENTING**
  Porous metal interior and specially designed hood dissipate heat evenly and safely . . . keep fixture temperature down, provide longer lamp life.
- **"INTERCHANGEABLE" UNILET BODY**
  Standardized diameters at top of Dome Unit Assembly permit interchange with AA-51 fixtures of varying wattages.

plus

conversion to different wattages or relamping in just *58 SECONDS!* . . . with no loss of man-hours or lengthy shutdowns. Send for complete information today!



58 SECOND RELAMPING

Photo Courtesy Oil and Gas Journal

APPLETON INTERCHANGEABLE UNILET BODY FEATURE

Note how identical diameters "A" on Dome Assemblies allow quick interchange of fixtures with different wattages.

Series AA-51 stand-by units are ready at an instant's notice for relamping . . . with handles attached in advance

Only a screw driver is needed to change units . . . and **ONLY 58 SECONDS** to climb ladder, change unit and descend!

Cleaning fixtures, changing burned out lamps can safely be attended to at bench . . . preventing costly shut-downs.

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Industrial Lights

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Outlet Boxes

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Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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Sidelights

RESIDENTIAL WIRING—Our special report on residential wiring this month "High Capacity Wiring for Modern Electric Homes", page 85, describes typical practice in wiring plans and distribution layout from studies of actual jobs which show the influence of modern industry developments.

The use of the term "high capacity" is not a substitute for "adequate" or "functional" but an emphasis on systems of 150 amps or larger service capacity with extensive use of special purpose circuits for individual loads. Such systems are often found in new homes designed for "electric living" with full air conditioning and the "all-electric" homes with full electric heating.

The description and details are drawn by Editor W. T. Stuart from a number of actual wiring plans and specifications of homes built within the past years and are consequently typical of current practice. No attempt has been made to include exceptional or spectacular installations.

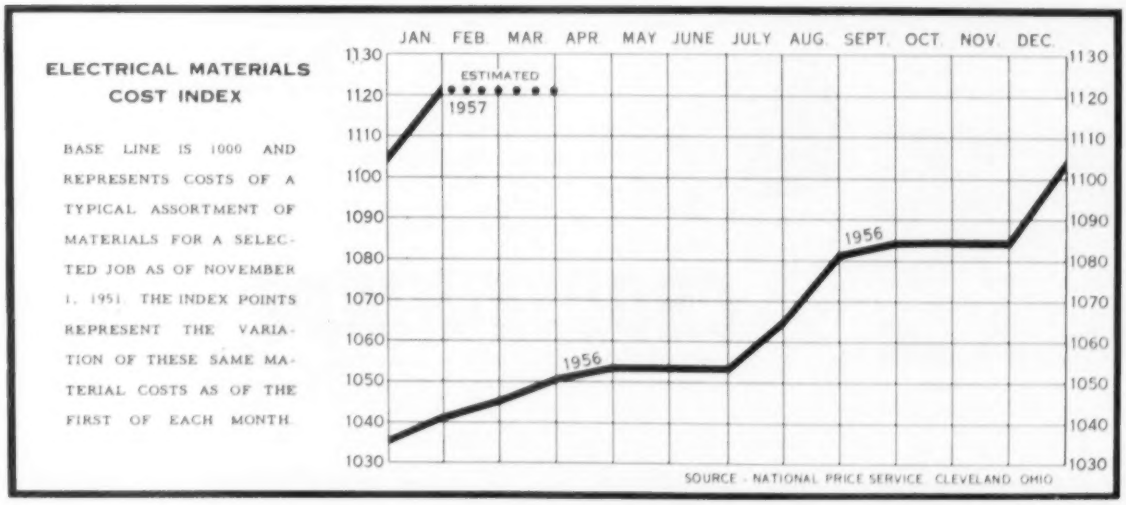
Because of the very rapid increase in the use of built-in lighting in modern homes, Eastern Editor Berlon C. Cooper has appended a separate report on "Better Light for Better Living" illustrating a number of practical lighting methods for modern homes.

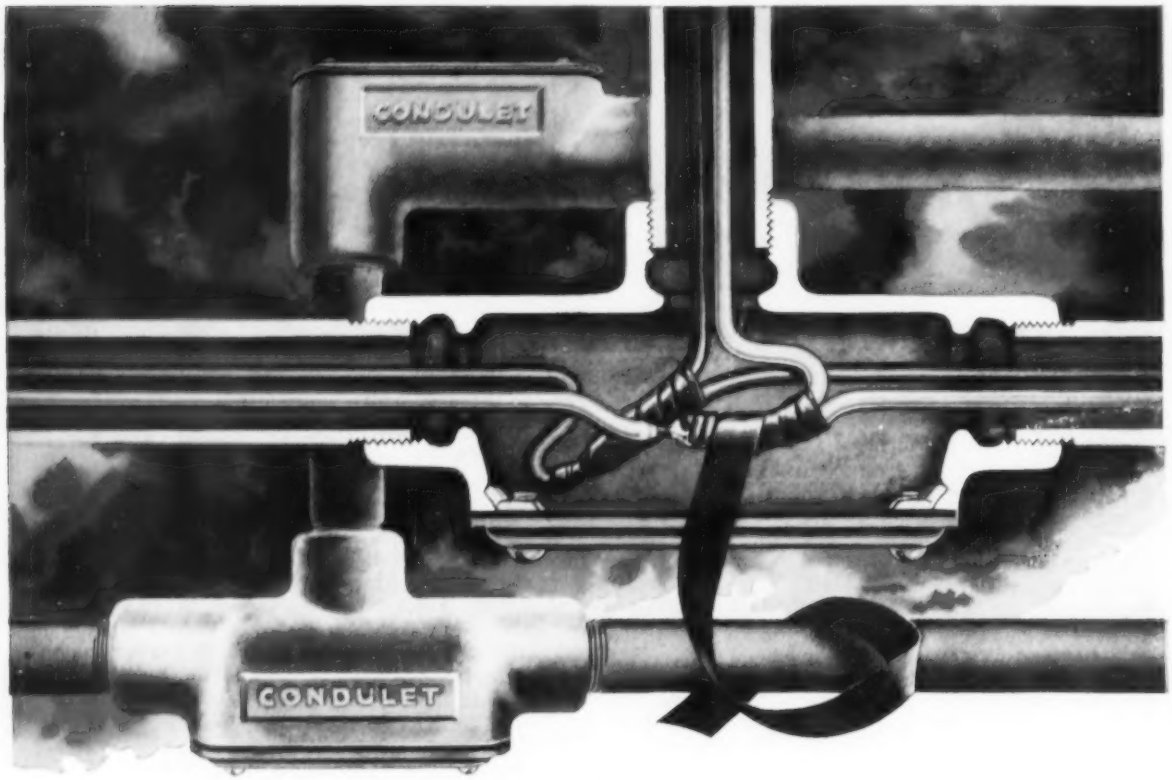
LIGHT AND HEALTH—When a Blue Cross organization in Southern California provides 125 footcandles of comfortable lighting throughout its new Los Angeles office building, it seems logical to conclude that Blue Cross officials believe that plenty of good light contributes to the good health of its employees. For details see "Model Environment for Office Workers", on page 108.

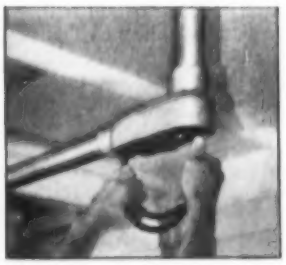
LIGHTING CONTEST—The lighting industry's biggest event for 1957 is a new Lighting Competition, now open for entries. Cash prizes total $5400, for 120 different awards. It is open to electrical contractors, electrical wholesalers, electric utilities, and architects and engineers. There will also be honorable mention awards and other forms of recognition for entries covering outstanding lighting installations of all types, indoors and outdoors—industrial, commercial, residential, floodlighting, etc. For complete details see announcement on page 98.

OUTSIDE DISTRIBUTION—With continuing expansion of power generating, transmission and distribution systems throughout the country, outside electrical construction work will continue to grow in volume. More and more pole lines and transmission tower lines will be needed to carry more and more power to old and new load centers of electrical utilization. And with growth in size and power consumption of industrial plants, construction of private pole line systems for high-voltage distribution will also expand. To continue our coverage of this important area of electrical construction, we present the story "Specs for a Wood Pole Line" on page 104, by J. B. MacLean, J. B. Kelly and E. E. Turner, electrical engineers experienced in design for outdoor construction. In preparation of the specifications for the job described, these engineers visited the site of the pole line and went over the route step-by-step to tightly relate the spec details to actual conditions. Only by on-the-job engineering can such detailed specs be prepared. The information presented here should be of interest to everyone concerned with wood pole work.

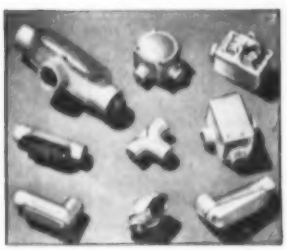
TRANSFORMER REWIND—A thorough analysis of rewinding a transformer with Class H insulation is the basis of the story "Silicone Transformer Rewind", by Earsil F. Stuart, manager of a Tulsa, Okla., motor repair shop. The story presents the background details of the rewind job, covers each step in the rewinding and insulating procedure, details the times and temperatures for dipping and baking operations and gives a test report on the finished job. This story is a valuable guide and reference source for motor and transformer service shops.


ELECTRICAL MATERIALS COST INDEX
BASE LINE IS 1000 AND REPRESENTS COSTS OF A TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. THE INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
1130
1120
1110
1100
1090
1080
1070
1060
1050
1040
1030
ESTIMATED
1957
1956
1956
SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO





Condulets install easily. There's room inside to do a good wiring job. No sharp edges to scrape knuckles or cut into insulation. Once installed, wiring, Condulet and conduit are there to stay—yet wiring remains easily accessible for future alterations.



Used everywhere. There is a Condulet for every need, in every conceivable industry. Each one bears the marks of superior construction. Each is made by craftsmen to the standards craftsmen demand!

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More than 15,000 items of Condulet electrical equipment offer a broad choice of explosion-proof, dust-tight or conventional construction unparalleled for safety and dependability. In *any* plant, the chances are 2 to 1 you will find Condulet junctions, switches, conduit fittings, plugs and receptacles, panelboards, pushbutton stations, motor control centers, etc. Wherever you see the name Condulet, you see the standard by which maximum performance is measured.

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Washington Report

The business boom is leveling out as economic trouble signs mount and business reports point to slowdowns in various economic sectors, although the boom pace is at a record plateau, as Washington economists point out. Some economic indicators in point: Steel demand softens; TV, appliance sales lag; copper prices decline; housing starts are headed down from last year's dip; gains in electric power output get smaller; building construction gains become smaller; many industries report new business harder to get.

Corporate profits after taxes in 1956 rose an estimated 2% only, according to Federal statistics, while total national production rose 5% and national income increased 6%, reflecting a reduced profit margin for business brought about by higher costs including rising wages and inflation.

Eisenhower's spending plans provoked wide public concern, brought forth a deluge of requests from taxpayers across the nation for budget cuts, more Government economy; dampened Congress' spending enthusiasm, gave new momentum to a drive by a few lawmakers to trim the new budget by some $3 to $5 billion. But most observers predict the $71.8 billion budget request will get trimmed little more than a token 2% or so. The public's anxiety reflected mostly inflation jitters and sentiment for tax relief, it was reported.

New construction spending in January dropped 10% below December, a seasonal decline, but still hit a record high for the month of $3 billion, about 3% higher dollarwise than the $2.9 billion total for January 1956. Private outlays declined 12%, to $2.2 billion, equal to a year earlier, while public spending dropped only 4% from December, for a record outlay 12% higher than a year earlier.

Major spending increases were for industrial plants, office buildings, churches, schools, hospitals and public utilities with private funds, and for highways, public schools, and sewer and water projects with public funds. Decline in spending was principally for construction of new homes, stores, and farm buildings.

New home building declined again in January to $895 million, about 16% below the December total and 9% below a year earlier. A further drop is forecast, and Congress was reported prepared to start pushing through legislation for still easier mortgage terms to halt the decline.

The Government shelved its "lease-purchase" program for Federal buildings in mid-February "to help curb inflationary pressures", it was announced by GSA which heads the program. But the program, in which buildings are constructed for Uncle Sam with private money then bought on installments over a period of 10 to 25 years with 4% financing costs, was already lagging badly, mainly because of "tight money", GSA officials concede.

Electrical apparatus and supplies sales for 1956 were 14% more than for 1955, Census Bureau reported, which compares with an 8% increase for total merchant wholesalers sales for both durable and nondurable goods.

Output of refined copper last year reached a record 1,580,287 tons, or 112,803 tons more than in 1955, the previous record year. Reduction in price to 34 cents and below has failed to spur demand, as over-supply builds up at an estimated 15,000 tons a month domestically.

Steel output in January set a record for the month, at 11,001,000 net tons, second only to the record monthly output of 11,048,513 net tons last October. Demand seems to be softening slightly, however, as reported by some producers.

Primary aluminum production reached a record 3.4 billion pounds last year, compared with the previous record of 3.1 billion pounds in 1955.

Mr. Ketchum (left) and J. C. Marvin of The Pacific Telephone and Telegraph Company, shown here in front of one of Mr. Ketchum's popular College Downs Homes in California's San Fernando Valley.

"Home buyers want concealed telephone wiring"

— says Mr. Russ Ketchum, Builder, of Van Nuys, California

"Here's why home buyers want concealed telephone wiring," says Mr. Ketchum. "They want telephone outlets located as conveniently as electrical outlets, and they want the finished beauty of their rooms preserved, too.

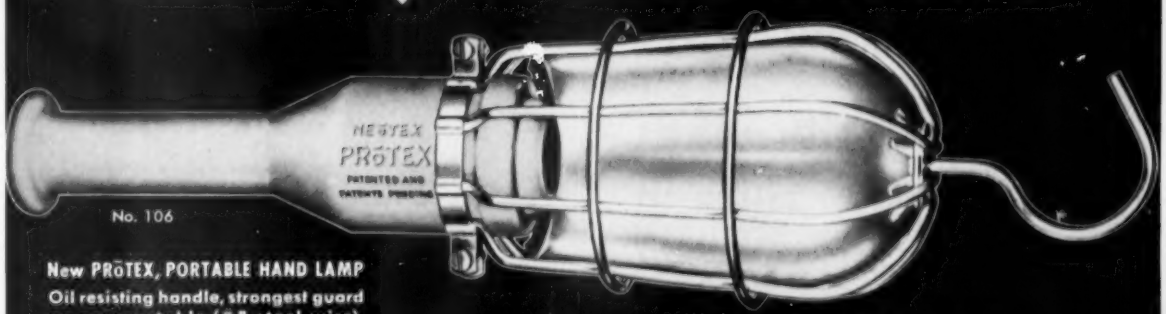
"I'm in business to give people what they want in homes, and today that means concealed telephone wiring along with the many other built-in, ready-to-work conveniences that people look for. I put concealed wiring and telephone outlets in every home I build. It's good business. It's a sales feature I wouldn't be without."

. . .

Your nearest Bell Telephone business office will help you with concealed wiring plans. For details on home telephone wiring, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

Working together to bring people together
BELL TELEPHONE SYSTEM

SAFETY ◆ IS OUR BUSINESS



No. 106

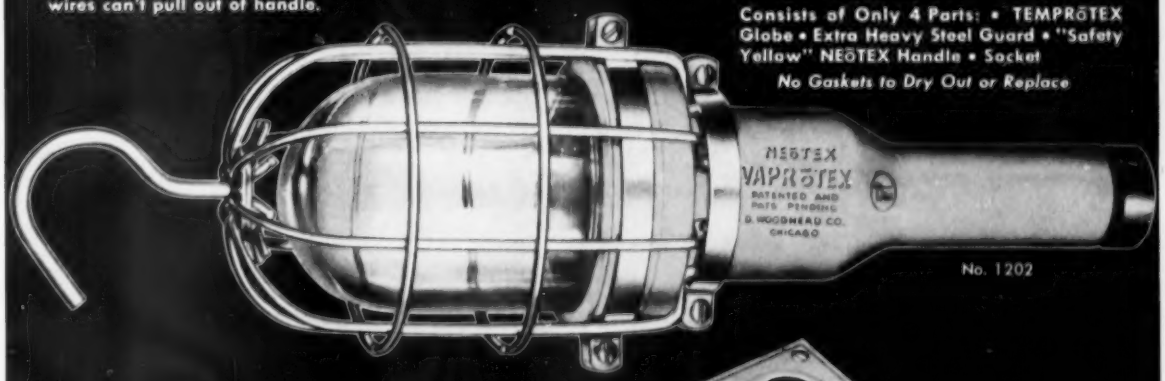
New PRŌTEX, PORTABLE HAND LAMP

Oil resisting handle, strongest guard on any portable (#8 steel wire). Full length light-saver reflector, taped splice for added safety . . . wires can't pull out of handle.

New VAPRŌTEX, Vaporproof PORTABLE HAND LAMP

Consists of Only 4 Parts: • TEMPRŌTEX Globe • Extra Heavy Steel Guard • "Safety Yellow" NEŌTEX Handle • Socket

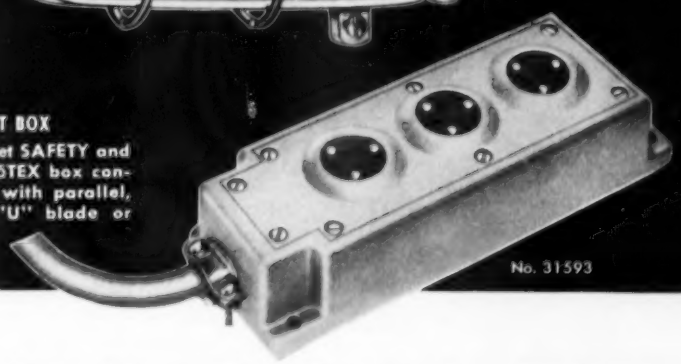
No Gaskets to Dry Out or Replace



No. 1202

New MULTI-TAP OUTLET BOX

Built for Multiple Outlet SAFETY and SERVICE with full NEŌTEX box construction. Available with parallel, tandem, crowfoot, "U" blade or Turnex receptacles.



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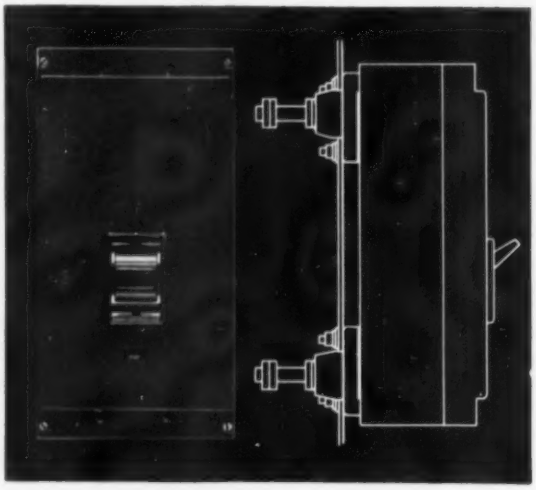
NEW

circuit breaker plug-in for switchboard mounting



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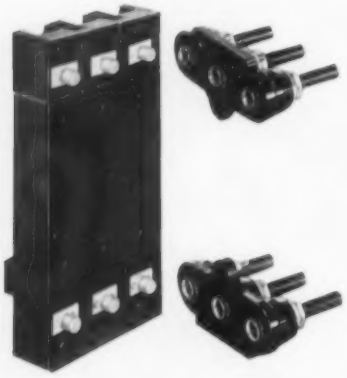

To install: (1) just plug in the breaker, and (2) fasten four bolts. It's that simple. For maintenance inspection or rating exchange, reverse the procedure.

You can't minimize the importance of safeguarding your men on the job. Now from Westinghouse you can have that protection in a standard AB breaker with new drawout terminals designed not only for safety but for ease of handling.

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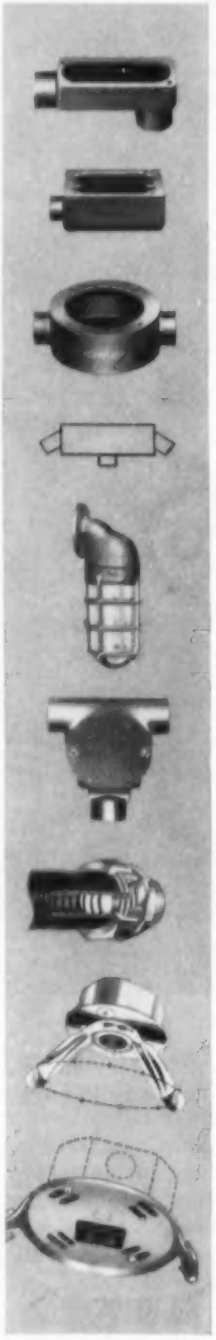
- **FS and FD SIMPLETS** Threaded and no-thread series. Single and gang units with device interchangeability feature. Covers include cast vapor-tight types with cork or neoprene gaskets.
- **ROUND SIMPLETS** Includes G, GRF, GRLF, H, SE, SEH, P, PM, OS and OSL, etc. series, in variety of hub styles and sizes. Cast or steel covers with cork or neoprene gaskets. OSL and GRF types ideal for embedding in concrete!
- **SIMPLET WEATHER-PROOF JUNCTION and PULL BOXES** Used in subways, underpasses, bridge abutments. Type A with 4 hubs, type B with 4 hubs at convenient 30° down angle. Extension ring gives greater depth, fits smaller diameter devices.
- **VAPORTIGHT FIXTURES** for universal application. Assorted sizes and styles including popular VW for masonry walls, VU for exposed systems, VO for mounting to sheet metal boxes. Same base with adapter provides quick changeover from 100-watt to 150 or 200-watt units. Long-lasting aluminum parts require no attention for years. Complete accessories including reflectors available.
- **HANGING DEVICES** include the ALC for use with incandescent systems. Accessories, trigger hook lock assemblies, pendant loops, and others.
- **VAP-OIL-TITE CONNECTORS** for use with vapor and oil tight flexible metal conduit. Provides positive seal, prevents costly shorts and down-time!
- **"FRICTION-SET" FIXTURE HANGERS** . . . align lighting systems with a twist of the wrist. Complete assembly.
- **NEW! LOW-COST FIXTURE HANGER** with 58° total adjustment. Provides fast, low-cost mounting right on boxes. Complete with chains, hooks and cord clips.



Ask your wholesaler to show you the new, complete line Catalog X-2000

get IDEAL

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CONDUIT FITTINGS and ELECTRICAL SPECIALTIES

DELIVERED FROM STOCK

You can get these conduit fittings and specialties quicker than any others in the industry . . . Because, Ideal-Simplet always maintains volume stocks at the factory ready for extra-fast delivery service. When you insist on Ideal-Simplet products by name . . . you can be sure you'll get your requirements *when* you need them!

Makers of the Fittings With These Outstanding Features . . .

- UL Approved
- Strong, rugged, durable
- More work area inside—screws in corners—no obstructions
- Ground surfaces for tighter cover, gasket seal
- Fastest delivery in the industry
- Field service help
- Covers packed with LB, C, E, T, LL, LR and LRL rectangular fittings if you prefer. No more searching for covers.
- Hundreds of styles and sizes available.

ORDER FROM YOUR WHOLESALER . . . NOW

Pioneers in Conduit Fittings and Electrical Specialties

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SIMPLET FITTINGS, Inc.

A Subsidiary of Ideal Industries, Inc.

1041-C Park Avenue, SYCAMORE, ILLINOIS

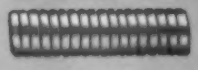
...that job calls for

COLUMBIA FLEX-SEAL

the new **FLEXIBLE LIQUID-TIGHT ELECTRICAL CONDUIT**

REDUCES MAINTENANCE
PREVENTS SHUTDOWN
EASY TO WORK WITH

FLEXIBLE STEEL CORE



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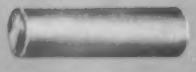
TOUGH, LIQUID-TIGHT VINYL SHEATH



=

Super Flexible FLEX-SEAL

FREE
Write for sample and specifications brochure.

IT'S LIQUID-TIGHT!

Flex-Seal has been designed specifically to meet the most adverse conditions—in chemical plants, machine shops, printing plants, food plants, breweries—any installation, indoors or outdoors, subject to moisture, coolants, salt air, corrosive fumes, chemicals, greases, abrasives, and other conditions that create hazardous wiring with ordinary conduit.

IT'S SUPER FLEXIBLE!

Because it bends easily to small diameters and because it fits the tightest corners and most irregular shapes, Flex-Seal is ideal for wiring on machine tools, motors, pumps, air conditioning towers, outdoor amusements, conveyors . . . machinery of every type.

IT'S ECONOMICAL!

Because the first cost is the last cost, Flex-Seal means genuine economy. It eliminates maintenance and prevents costly shutdown. Flex-Seal is easy to install too, cuts easily on the job without special tools. And, its machine grey finish stays cleaner-looking longer.

2 TYPES TO MEET EVERY REQUIREMENT

Sizes: ⅜" through 2" Color: Machine Grey
For installation with standard liquid-tight electrical fittings

COLUMBIA CABLE & ELECTRIC CORP.
Serving the Electrical Wholesaler Since 1912
255 CHESTNUT STREET BROOKLYN 8, N. Y.

For the FIRST time EVER: ONE low-priced tester provides ALL the services listed below!

SUPERIOR'S NEW MODEL 70 *UTILITY TESTER

*T.M. REG. U.S. PAT. OFFICE

Compact — Measures 3⅛" x 5⅞" x 2¼"

It's a

VOLTMETER

A.C. and D.C. to 300 volts. Low range, 0-15 volts; 150 volt range for 110 volt lines; 300 volt range for 220 volt lines. *A.C. and D.C.* voltages read on exact same scales — no correction factor.

It's an

AMMETER

A.C. and D.C. to 15 amperes. See details of unusual feature specified below.

It's an

OHMMETER

0 to 1000 ohm range will measure all common resistances. Low resistances easily read.

It's a

LEAKAGE INDICATOR

Indicates leakages up to 5 Megohms.

SPECIFICATIONS:

VOLTMETER SECTION

The Model 70 provides 3 voltage ranges: 0-15 volts, 0-150 volts, and 0-300 volts. A unique feature of the improved moving vane type of meter used in this tester is its ability to measure both A.C. and D.C. without use of a rectifier. This eliminates the necessity of using separate A.C. and D.C. scales. Furthermore, a newly designed damping chamber in the meter movement insures stability without sacrifice of accuracy.

AMMETER SECTION

The 0-15 Ampere range (both A.C. and D.C.) provides 90% of common current measuring requirements. The Model 70 will measure current consumption of a circuit or appliance without breaking any wires and *while the unit is in operation.* Simply plug appliance into socket on front panel of tester. Current consumption may then be read direct, on the meter. Current measurements may also be made in the conventional manner.

RESISTANCE SECTION

Model 70 incorporates a direct-reading 0-1000 ohm resistance range which will accurately measure the resistances commonly used in appliances, motors, etc. This range is used most frequently for continuity checks and tests for opens, shorts and grounds.

LEAKAGE INDICATING RANGE

Safe to use, because, a safe-guard resistance built into this circuit limits the current to one thousandth of an ampere. Will indicate up to 5 Megohms. Use this service for checking motors, contactors, etc.

Added Features

Model 70 will test tubes. The majority of inoperative tubes stop functioning due to open filaments, inter-element shorts and other faults which can be located by the continuity and leakage method. Please note, the Model 70 will not test the quality of a tube (an emission tester is required for that purpose), but the Model 70 will test ALL tubes for open filaments, burned out tubes, etc. A safe-guard resistor included in the circuit network of the Model 70 limits the output to approximately one one-thousandth of an ampere. This insures positive safety for the non-technical user and also eliminates the possibility of ever burning out a tube under test.

Also — tests Storage Batteries

Will test all 6 volt and 12 volt storage batteries. In addition to the 6 volt and 12 volt calibrations, a 2 volt calibration permits testing of individual cells. (All storage batteries actually consist of individual 2 volt cells connected in series.)

Model 70 comes housed in a round-cornered, molded bakelite case. Complete with all test leads and a profusely illustrated 64 page book written in plain, easy-to-understand language. Only.

$15.85 NET

SUPERIOR INSTRUMENTS CO.

2435 WHITE PLAINS ROAD, Dept. U-1, NEW YORK 67, N. Y.

CRESCENT WIRES & CABLES

Unexcelled for Value
Safety and Endurance

OVER
70
YEARS
EXPERIENCE

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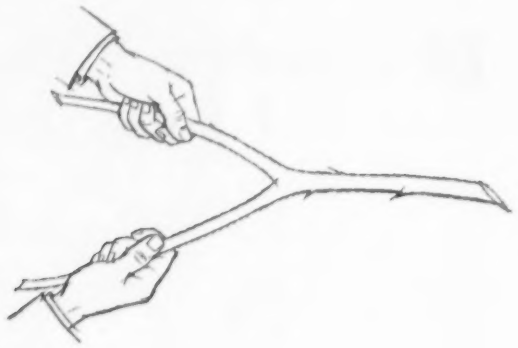
OVER 70 YEARS EXPERIENCE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, NEW JERSEY

***DODGE REPORTS** point out new construction business the way old divining rods were supposed to find water. So don't trust to luck . . .*



Write for a better way to turn up new construction business

There's no divining rod guesswork in the way Dodge Reports give you a head start on finding new construction business — it's all facts! So, if you want to know where you can find live, active prospects for your product or service, just read, then mail this coupon today.

TO: **DODGE REPORTS**, 119 WEST 40th STREET, DEPT. 91, NEW YORK 18, N. Y.

Yes! I'd like to pin-point my prospects by knowing in advance who's going to build, what, when, where.

I want to know whom to contact and when to submit bids.

I'd like to see some Dodge Reports and I'd like a copy of your booklet that tells how to use this accurate, daily, up-to-the-minute construction news service.

I understand that I can pick just the area and type of construction activity that interests me. Also, that I won't have to wade through mounds of data to find the information I need.

I'm interested in General Building ☐ **House Construction** ☐ **Engineering (Heavy Construction)** ☐

in the Following Area: _____

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CITY _____ ZONE ____ STATE _____

Dodge Reports
For Timed Selling to the Construction Industry

the O.Z. SHURELUG

has more of the features you want...

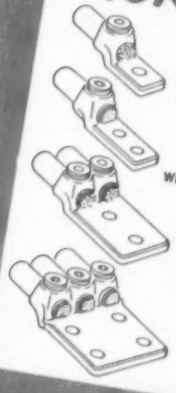
O.Z. means more for you

The O. Z. ShureLug is the newest addition to the complete O. Z. line of electrical fittings; more proof of O. Z.'s policy to make available dependable products at realistic prices.

MORE SIZES

The new O. Z. ShureLug is available for a wide range of sizes, including "in between" sizes usually found only in more expensive makes. This means that whether the job calls for #14 sol. or 1000 MCM cable, there will be an O. Z. ShureLug that will meet your needs more closely, more exactly, for a more secure, more dependable connection.

MORE MODELS



Here's variety too!: O. Z. ShureLug is available in single barrel, double barrel, and triple barrel models . . . with socket heads or hex heads . . . in single hole, double hole, and four hole styles, depending upon sizes selected. Here again, premium selection at practical prices!

MORE ECONOMY

O. Z. ShureLugs are priced no higher than other competitive brands, but you get so much more! Because O. Z. ShureLug is made in more sizes, more models, you buy only the capacity you actually need . . . only the capacity that you'll actually use. Why spend more for over-sized lugs when O. Z. has the size you want, the model you need, at the low economical prices you want to pay?

O.Z. ELECTRICAL MANUFACTURING CO., INC.
262 BOND STREET • BROOKLYN 17, N. Y.

CAST IRON BOXES
CABLE TERMINATORS
POWER CONNECTORS
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Answers to

about Kaiser Aluminum's purchase of

As part of its continuing growth program, Kaiser Aluminum & Chemical Corporation recently purchased the Wire and Cable Division of United States Rubber Co., located at Bristol, Rhode Island. The purchase raises a number of questions that are of direct interest to customers of both Kaiser Aluminum and the former Wire and Cable Division of U. S. Rubber. Here are the answers to those questions.

Q. Will all of the U.S. Rubber products still be available?

A. Yes, ALL of the wire and cable products formerly offered by U.S. Rubber will continue to be produced and sold—without changes of any kind.

Q. Who will back up the U.S. Rubber guarantees now? What about replacement?

A. Kaiser Aluminum will guarantee all U.S. Rubber Wire and Cable Division products now in use on the same terms as originally established, including replacement. Former U.S. Rubber products (which will continue to be offered) will carry the same guarantees as before.

Q. I have always liked the way U.S. Rubber people have served my needs; who will be doing the job now?

A. The same people who served you before will serve you now. The purchase includes acquisition of Wire and Cable Division's nationwide sales organization, as well as the plant work force of 1200 people.

Q. Will the price structure remain the same?

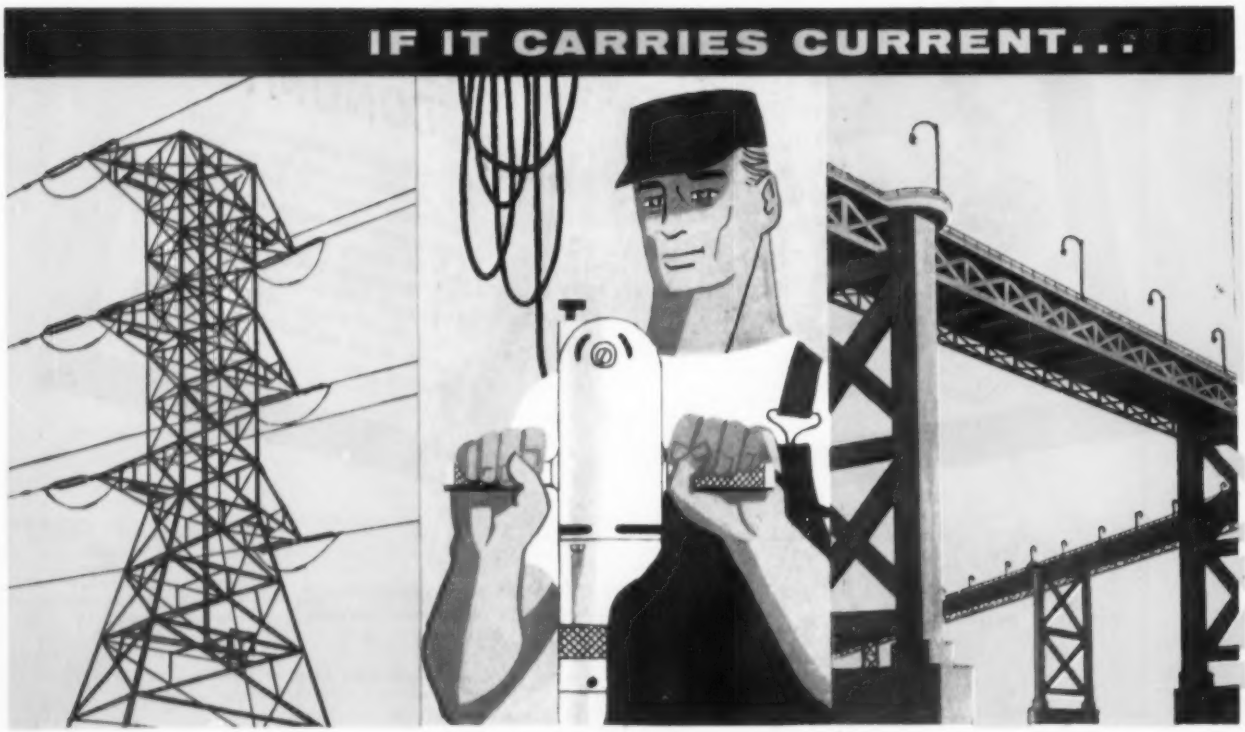
A. There will be no change in price structure as a result of the purchase. Kaiser Aluminum will continue to be a leader in maintaining a stable price structure throughout the market.

Q. Can I now buy both aluminum and copper electrical conductor from Kaiser Aluminum?

A. Yes—and in a wider variety than formerly available from either source. One of the primary effects of the purchase is to broaden the product range offered by Kaiser Aluminum in both aluminum and copper conductors.

Q. How about the insulations used in U.S. Rubber products: will the quality still be the same?

A. These high-quality insulations will remain exactly the same in every specification detail. In fact, they will be *supplied* by U.S. Rubber. Continued research cooperation will exist between the U.S. Rubber scientists and engineers and Kaiser Aluminum.



your questions

U. S. Rubber Wire and Cable Division

Q. Will new people from both companies be calling on me?

A. There will be no duplication of calls, because former U.S. Rubber personnel will be prepared to present the entire, broadened product line to those customers who can benefit by it. Occasionally, Kaiser Aluminum specialists will accompany the former U.S. Rubber representatives to help present the complete line. Conversely, Kaiser Aluminum Sales Representatives will be prepared to present the new, complete line to their established customers, assisted by former U.S. Rubber specialists.

Q. I formerly bought through a Kaiser Aluminum or U.S. Rubber distributor outlet. How will this be changed?

A. The distributor who formerly carried U.S. Rubber wire and cable will continue to offer the same products with no change. Present Kaiser Aluminum Distributor outlets also will remain unchanged.

Q. Will there be any effect on the Field Engineering Services formerly available through either company?

A. The technical assistance available to you will be greatly increased. Kaiser Aluminum—as the nation's largest producer of covered aluminum wire—is already a leader in research and product development, both in the laboratory and in the field. Now, by acquiring additional highly skilled technical personnel, these services will be further strengthened.

Q. How will the new setup affect my delivery date?

A. The convenience of a new eastern plant location, plus additional sales representatives and distributors, will mean even faster and more efficient service.

* * *

The purchase of the Wire and Cable Division of United States Rubber puts into operation the twenty-third plant for Kaiser Aluminum, which started with three plants just ten years ago.

This growth is based on the continued support of our customers, who, working with us, have helped to make Kaiser Aluminum the nation's fastest-growing major producer of aluminum. This latest acquisition represents another step forward in our program of complete service to the nation's rapidly-expanding electrical industry.

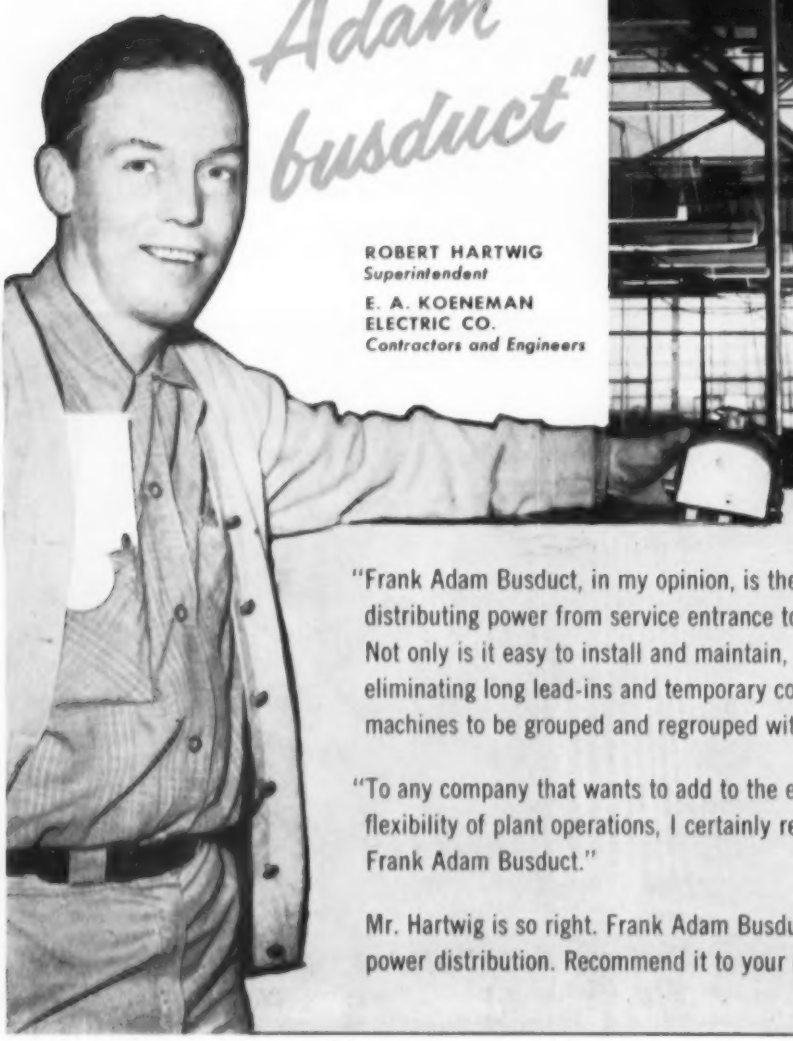
Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, California; *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois.

Kaiser Aluminum

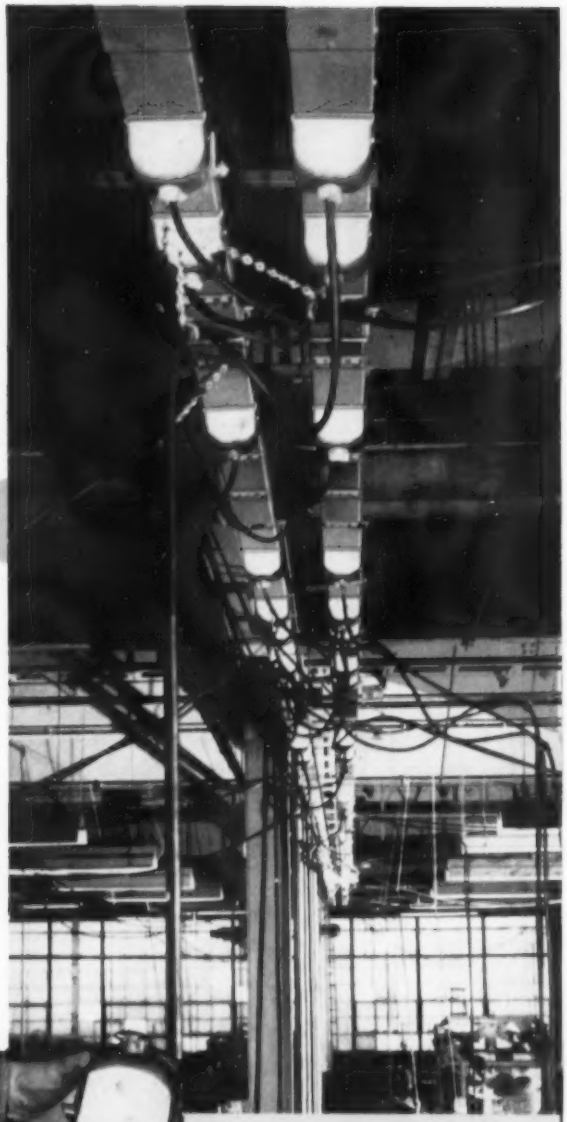
See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.

FOR EFFICIENCY,
ECONOMY
AND FLEXIBILITY
of plant operation...

"I reccommend Frank Adam busduct"



ROBERT HARTWIG
Superintendent
E. A. KOENEMAN
ELECTRIC CO.
Contractors and Engineers

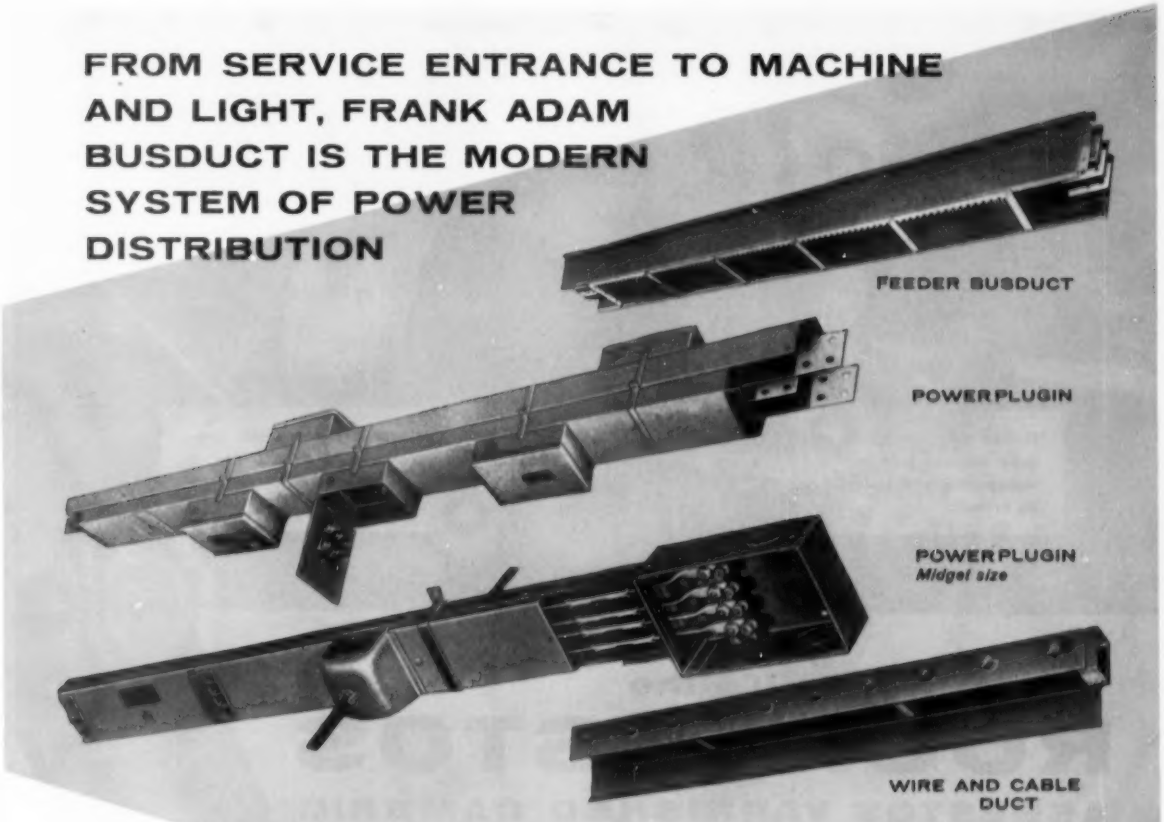


"Frank Adam Busduct, in my opinion, is the ideal system for distributing power from service entrance to machines and lights. Not only is it easy to install and maintain, but it reduces voltage drop by eliminating long lead-ins and temporary connections. Also, it enables machines to be grouped and regrouped without disrupting production.

"To any company that wants to add to the efficiency, economy and flexibility of plant operations, I certainly recommend Frank Adam Busduct."

Mr. Hartwig is so right. Frank Adam Busduct is the modern system of power distribution. Recommend it to your customers.

FROM SERVICE ENTRANCE TO MACHINE AND LIGHT, FRANK ADAM BUSDUCT IS THE MODERN SYSTEM OF POWER DISTRIBUTION



For connections for machines, closer grouping of equipment and distributing power from service entrance to machines, Ⓕ POWERPLUGIN with plug-in outlets every foot of the way is particularly ideal. Available also with plug-in outlets on 20 inch centers on both sides. Ratings 225 to 1500 amps.

Ⓕ POWERPLUGIN—MIDGET SIZE provides "plug-in and go" power for all small installations. Made in five and ten foot sections with plug-in outlets every 12 inches. Sections can be run overhead, along walls, etc. Rating 100 amp, 250 volts.

For conducting heavy current from service entrance to distribution center Ⓕ Feeder Busduct with copper or aluminum conductors is unsurpassed. Available in single bar and Hi-Efficiency types. Ratings 600 to 4,000 amps, 600 volts.

Ⓕ WIRE AND CABLE DUCT or Auxiliary Gutter. Ideal for bringing number of wires into limited space.

if it's FA *it's* OK

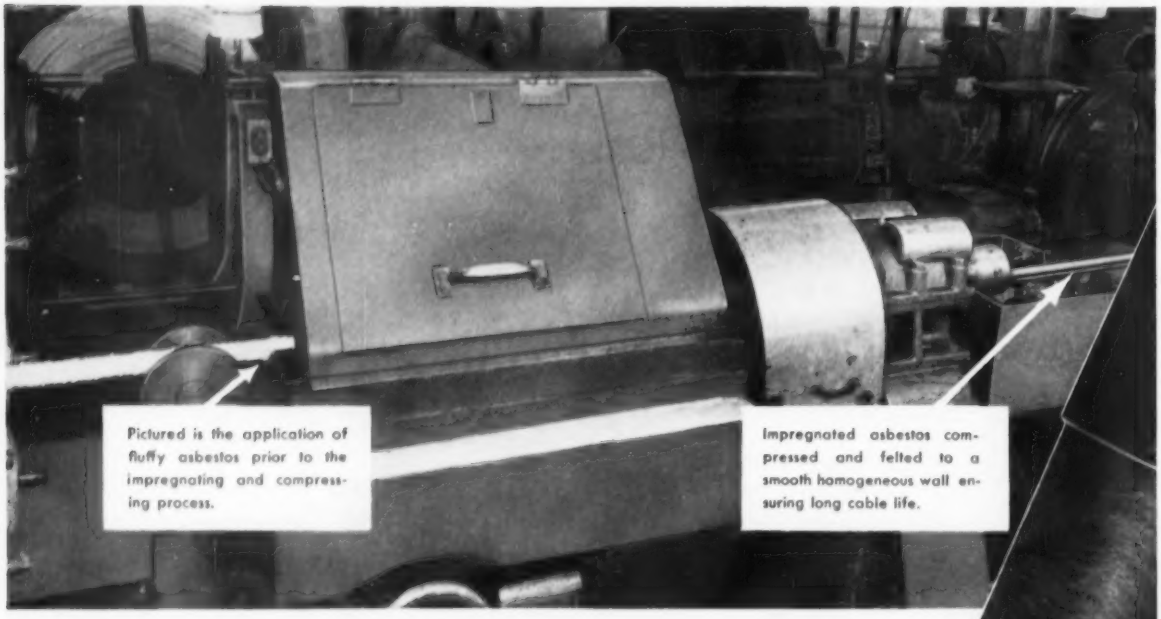
FRANK ADAM

For information on all Ⓕ products, contact your nearest Ⓕ representative listed in Sweet's. He'll be glad to provide it.

FRANK ADAM ELECTRIC CO.

MAIN P. O. BOX 357 • ST. LOUIS 3, MO.

makers of
busduct • panelboards • switchboards • service equipment
safety switches • load centers • Quikheter



Pictured is the application of fluffy asbestos prior to the impregnating and compressing process.

Impregnated asbestos compressed and felted to a smooth homogeneous wall ensuring long cable life.

It's the

ROCKBESTOS

ASBESTOS VARNISHED CAMBRIC

COMBINATION

Beneath the Braid that Assures Long Cable Life

Seamless Felted Asbestos Walls

+ Impregnation with selected compounds

+ Quality Varnished Cambric Tapes

N.E.C. Type AVA Wire and Cable may look alike on the surface. But a look under the braid will quickly show why the Rockbestos A.V.C. gives longer lasting service.

First, two dense, uniformly impregnated felted asbestos walls seal the varnished cambric tapes. They keep the dielectric strength high . . . give added strength against damage and flexing.

Second, the varnished cambric tapes are made to *our own exacting specifications* which incorporate standards beyond those called for by industry.

Add to this, thirty years of know-how in the application of asbestos and VC Tapes to Rockbestos A.V.C. and you get wires and cables that eliminate costly rewiring jobs and expensive maintenance . . . assure long cable life.

Write for the new booklet "Specification RSS 88" which gives complete construction and test specifications.

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH • ST. LOUIS
LOS ANGELES • NEW ORLEANS • OAKLAND, CALIFORNIA • SEATTLE

STOCKED COAST TO COAST
Standard Rockbestos A.V.C. construction (N.E.C. types AVA, AVB, etc.) are available for immediate shipment. Call or write nearest branch office.

For top value... in any type... get JENKINS

Gold Seal Tape

FRICTION · RUBBER · PLASTIC

"Tape-saver" size, we call these 20 ft. rolls you get in the 10-roll container of Gold Seal Plastic Tape. It's enough for the average job . . . less tape gets "lost". Workers like the small size. It "swings" easily in tight places.

You get every advantage of Plastic Tape with the plus of proved Gold Seal quality. Try it . . . sample free. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

ELASTIC—
MOLDS TO SHAPE

TOUGH PLASTIC DEFIES
WATER, OIL, SOLVENTS,
SUNLIGHT, AND WEATHER

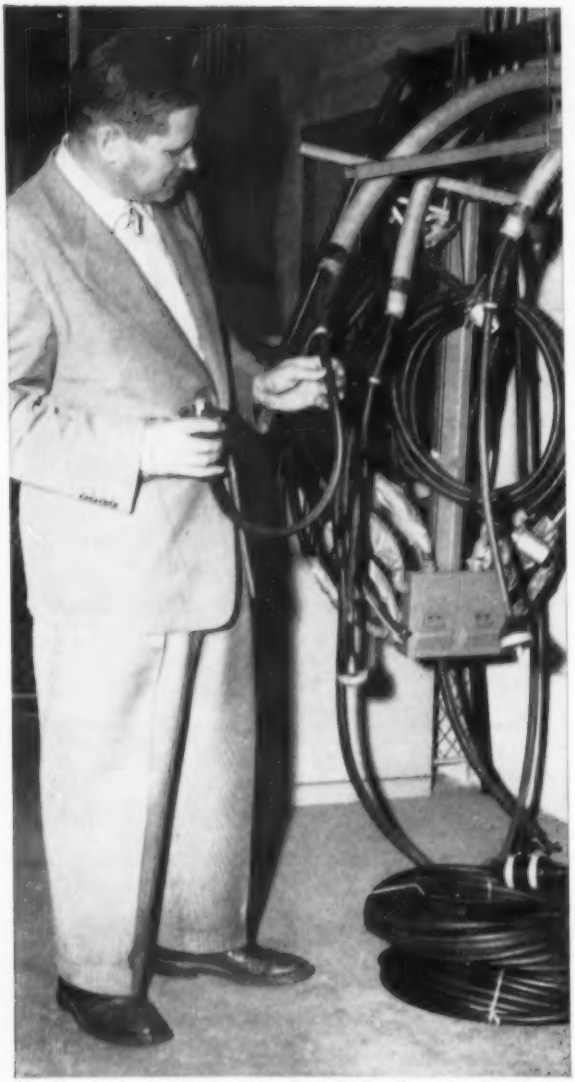
STICKS ON—
STAYS ON

NEAT, THIN
WRAPPING
FULLY INSULATES

TRADE JENKINS MARK

Jenkins Bros.

Gold Seal Plastic Tape — Handy Pack of ten 20 ft. rolls and single 60 ft. rolls in round metal cans.



Mr. Maginniss inspects a Tiger Brand pigtail coming from end of a vibrator tool.

"We've never had a complaint about Tiger Brand Amerclad!"

says H. J. Maginniss, President
Maginniss Power Tool Company, Mansfield, Ohio

Here's a success story for you. In 1947, Mr. Maginniss started his company with one employee—himself. One year later, he added one more employee. Today, he has 35, and business is booming. His only product is an electric generator-vibrator system that knocks the entrapped air out of freshly poured concrete so that it is denser and stronger.

Early in the game, Mr. Maginniss learned that construction men did not exactly baby his tools. As a result, everything is built as ruggedly as possible, and that includes the cable, which is four-conductor, No. 12 AWG Tiger Brand Amerclad. Sometimes the cable drapes over several stories of scaffolding and is dragged over rough concrete, wooden beams and steel piling—while heavy trucks roll over it down on the ground. Despite all this, they have never had a complaint about the cable.

Do *you* need this kind of quality? Your AS&W salesman will give it to you!

Harry Bunton paints a vibrator. Notice heavy casing around cable near the hand hold.

Here is a cable casing that was damaged in use. Cable inside was not injured.

Workman ready to drop tool into concrete. Electric generator is on ground.

See the snarl of cable between tool and generator. Tiger Brand is made for this treatment.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TIGER BRAND ELECTRICAL WIRE & CABLE

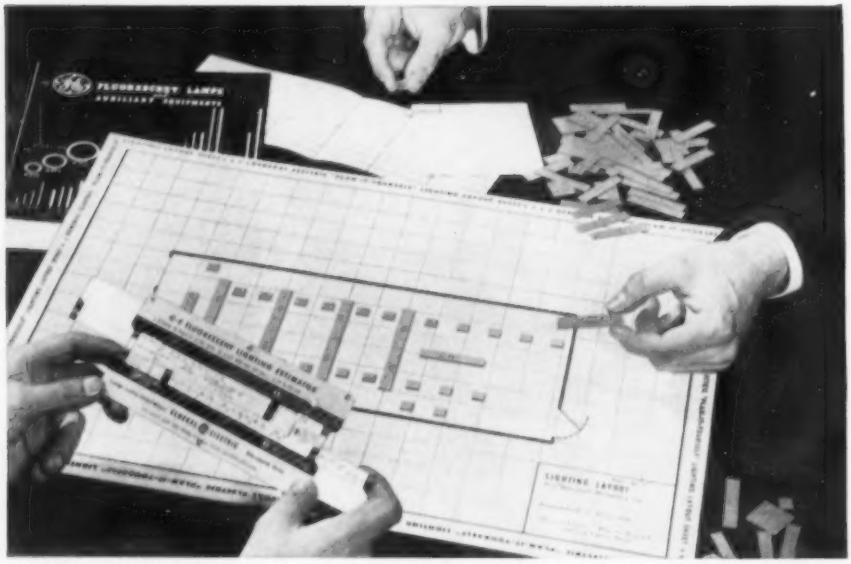
A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- asbestos wire and cable
- mold cured portable cord
- shovel & dredge cable
- paper & lead cable
- varnished cambric cable
- interlocked armor cable
- special purpose wire & cable
- aerial, underground and submarine cable

USS

UNITED STATES STEEL

"This kit



G-E Lighting Layout Kit *contains layout sheets; a fluorescent lighting estimator; movable, scaled "fixtures"; gummed "fixtures" for your permanent layout; and a lighting design guide.*

helped me

Mr. Harry K. Flynn *of Welch Electric Co., Urbana, Ohio.*

sell three lighting jobs worth $1,300 . . . all the same day"

New General Electric "Plan-It-Yourself" Lighting Layout Kit can help you sell More Lighting Jobs, Too!

Mr. Harry K. Flynn of Welch Electric Co., Urbana, Ohio, read about the new G-E *Lighting Layout Kit* . . . sent for it . . . and put it to work. *The next day, he used it to help sell 3 lighting jobs totaling over $1,300 worth of business!* Here's how a G-E *Lighting Layout Kit* can help you make more sales, too:

1 **YOU'LL SELL EASIER** because your prospect is in on the planning and he helps sell himself. He visualizes his lighting requirements more easily.

2 **YOU'LL "SELL UP".** Your prospect sees why the new lighting layout fits his needs, so you can sell him a better lighting job . . . and make more profit!

3 **YOU'LL "CLOSE" MORE SALES.** Your prospect okays the completed layout and your sale is half closed, even before a complete cost estimate is made.

Get your G-E Lighting Layout Kit from your General Electric Lamp Supplier today!

Or send $1.75 to: General Electric Co., Large Lamp Dept. EC-3, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

See What Square D's Front-Connected *POWER-STYLE* Switchboards Offer!

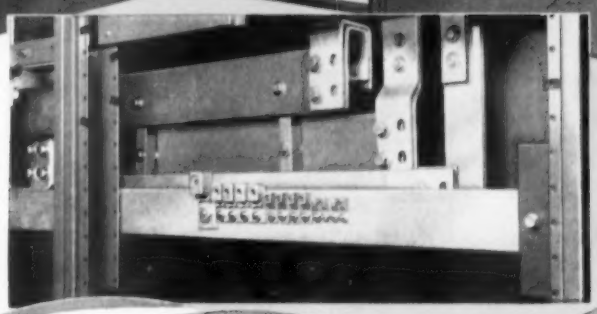
NEW!

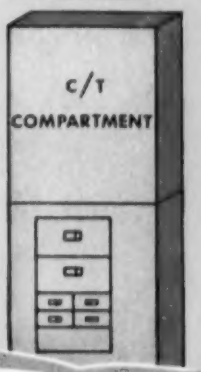
First *completely standardized* switchboard built specifically for small and medium-size installations. Bus bars designed to assure *cool operation in a depth of 14 inches!*

Complete *front accessibility* allows all bus bars and branch circuit connections to be installed and removed *from the front!* Permits mounting directly against wall.

Off-center mounting of breakers (or QMB fusible switches) in right hand section provides maximum room for installing cables from larger units.

Standardized C/T compartment built to meet Edison Electric Institute and Public Utilities' specifications.





Completely standardized horizontal bussing is available up to 2000 amperes, at either top or bottom. Notice bus bar drillings for extension to future sections.

Standardized C/T compartment designed to provide most flexible arrangement. Available in either "hot" or "cold" sequence, top or bottom feed. When used without main disconnect in "hot" sequence, up to six subdivisions can be mounted in same section with C/T compartment.

Write for descriptive bulletin
Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan

SQUARE D COMPANY

3 reasons why

UPTEGRAFF

1. Reliability

They know Uptegraff transformers are top quality . . . fully guaranteed . . . meet ASA, NEMA and AIEE standards . . . have a proven record of superior performance . . . have been designed and manufactured by Uptegraff for over 30 years.

Up to 10,000 KVA—all top quality.

Uptegraff Power Transformers are made for either power transmission and distribution or for industrial power utilization.

Load center-liquid and dry type.

Designed for location at center of load. Liquid filled—oil or askarel. Dry type —Class B or Class H insulation.

Before specifying electrical equipment for new or expansion of existing systems, see this helpful engineering data, described in the coupon.

Large stock of dry type lighting transformers.

For serving almost any lighting application. Available from stock in sizes ranging up to 150 KVA.

many companies select

TRANSFORMERS

2. Versatility

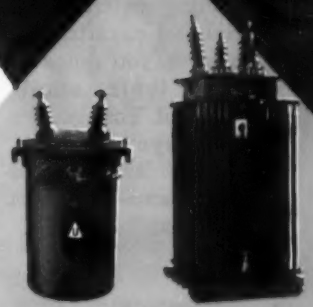
They know that Uptegraff transformers are available in a wide range of sizes and types . . . and that Uptegraff has engineering and manufacturing facilities to provide special types for exact customer requirements.

3. Dependable Delivery

They have found that Uptegraff service is prompt and efficient . . . unnecessary delay is eliminated . . . the people of Uptegraff are vitally and personally interested in serving their needs.

That's why more and more companies are standardizing on Uptegraff transformers. They like the top-quality performance, long life and low over-all cost . . . as well as the personal and efficient service.

R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pennsylvania



Overhead and station-type distribution.
Made in various sizes from 3 to 500 KVA and for a wide range of applications. Conforms to latest EEI and NEMA proposed standards.

Mail Coupon Today!

FOR FREE ENGINEERING DATA

Attach coupon to company letterhead. Our Engineers welcome inquiries on any of your requirements—standard or special.

R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pennsylvania

R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pennsylvania

Gentlemen: Please send available literature on

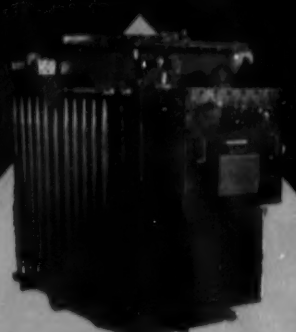
Power Transformers ☐ Load Center Transformers ☐
Lighting Transformers ☐
Station-Type Distribution Transformers ☐
Overhead Distribution Transformers ☐

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____



Network transformers.
Conventional and submersible types. Designed and manufactured for standard or special requirements.

YOUNGSTOWN "BUCKEYE" CONDUIT

. . . Provides Lifetime Wiring Protection For Frank Lloyd Wright's Modernistic Price Tower

At Bartlesville, Okla., the H. C. Price Co.—veteran oil and gas pipeline construction firm — recently opened their beautiful, new cantilever-design Price Tower. Containing both offices and residential apartments, this 19-story, fully air-conditioned structure uses Youngstown "Buckeye" full-weight rigid steel conduit for protection of its important electrical wiring system from damaging elements such as water, moisture, vapor, dirt and dust.

Field reports across-the-nation state: "Youngstown's 'Buckeye' Conduit is easier to bend—easier to fish wires through and, due to its superior corrosion resistance, affords a much longer trouble-free service life."

Leading distributors in every industrial and electrical market are ready to serve you quickly and efficiently from their ample stocks of Youngstown "Buckeye" Conduit. They're as near as your phone—why not call today?

QUALITY YOUNGSTOWN SERVICE

Price Tower, Bartlesville, Okla.
Owner: H. C. Price Co.
Architect: Frank Lloyd Wright
General Contractor: Culwell Construction Co., Oklahoma City, Okla.
Electrical Contractor: Industrial Electric Co., Oklahoma City, Okla.
Conduit Supplier: Westinghouse Electric Supply Co., Oklahoma City, Okla.

Standard-threaded rigid steel conduit is the only wiring system approved today by the National Electrical Code as moisture-, vapor-, dust- and explosion-proof for use in hazardous locations and occupancies.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon, Alloy and Yoloy Steel
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

Listen, friends, to the hideous fate of the man who learned about cables too late

Lucius K. Watt was an engineer
He was eager and honest and able,
And one of the things he did for his firm
Was to buy electrical cable.

Now he knew all the people at Okonite
But with orders he'd seldom reward 'em,
"Because," he would state, "the cables are great
But who in the world can afford 'em?"

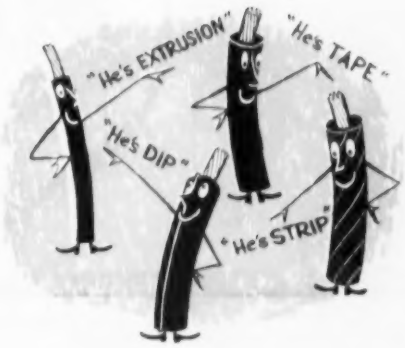
(Now that was a fault of the late Lucius K's—
That he had such a silly illusion;
For Okonite insulates cables *all* ways:
Strip, taping, dip and extrusion.

Only Okonite uses all methods, you see—
Our prices are *not* always highest;
And thus when you ask us what cable to use
Our recommendation's unbiased.)

So Lucius K. Watt went out and he bought
A cable he heard was a bargain
And this was too bad, for Lucius was had . . .
By some Madison Avenue jargon.

The thing was installed (with a minor defect)
In a most inaccessible place;
When Lucius K. Watt went out to inspect . . .
The cable blew up in his face!

We hate to relate this horrible fable
But here is the moral for all:
If you should desire a superior cable—
By extrusion or strip . . . by taping or dip
Just write us a letter, or call.



No matter *what* insulation or method of application you want (and we use them all) you'll get the best of its kind from Okonite. For a frank, down-to-earth discussion on cable insulating methods, write for Bulletin EC-1106, The Okonite Company, Passaic, N. J.

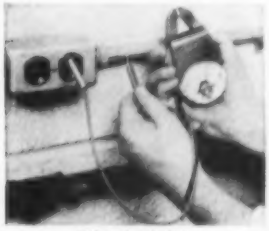
***where there's electrical power . . . there's* OKONITE CABLE**

4754

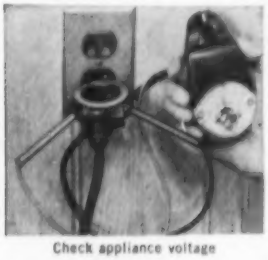
Check appliance current

Trouble-shoot relays quickly

what voltage tester does all these jobs?

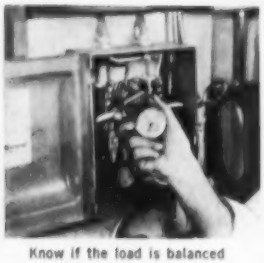


Determine hot leg



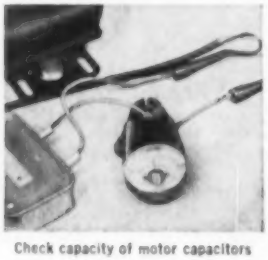
Check appliance voltage

Determine if fuses are good



Know if the load is balanced

Know if windings are grounded



Check capacity of motor capacitors

only Amprobe Jr.® measures both VOLTAGE and CURRENT!

Pocket-size, snap-around volt-amp. tester...

only $19.85

Why settle for an ordinary voltage tester when AMPROBE JR. gives you so much more . . . but *costs* so *little* more.

AMPROBE JR. measures current as well as voltage. Gives you an actual calibrated reading . . . not just an indication. Measures within ±3% accuracy. Comes in a full line of models to meet every testing problem. Protects you against shorts and shocks. Balances loads, locates grounds, determines motor overloads, checks rating of circuit-breakers.

DON'T BE HALF-EQUIPPED. Join the tens of thousands of electricians who rely on AMPROBE JR. the rugged, inexpensive pocket-size tester that does *every* job better, saves you time and money, prevents mistakes and costly call-backs. There's an AMPROBE JR. for every job . . . five different current models in either 125-250V A.C., or 150-600V A.C. Have your jobber show you the model that fits *your* job best.

don't guess at it; "AMPROBE" IT!

AMPROBE IS A DIVISION OF PYRAMID INSTRUMENT CORP., MANUFACTURER OF REMCON SIMPLIFIED LOW-VOLTAGE SWITCHING DEVICES.

HOW TO MAKE MORE MONEY IN LESS TIME.
Send today for free profit-boosting tips.

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Please send me, without cost or obligation, the free service bulletins checked below:

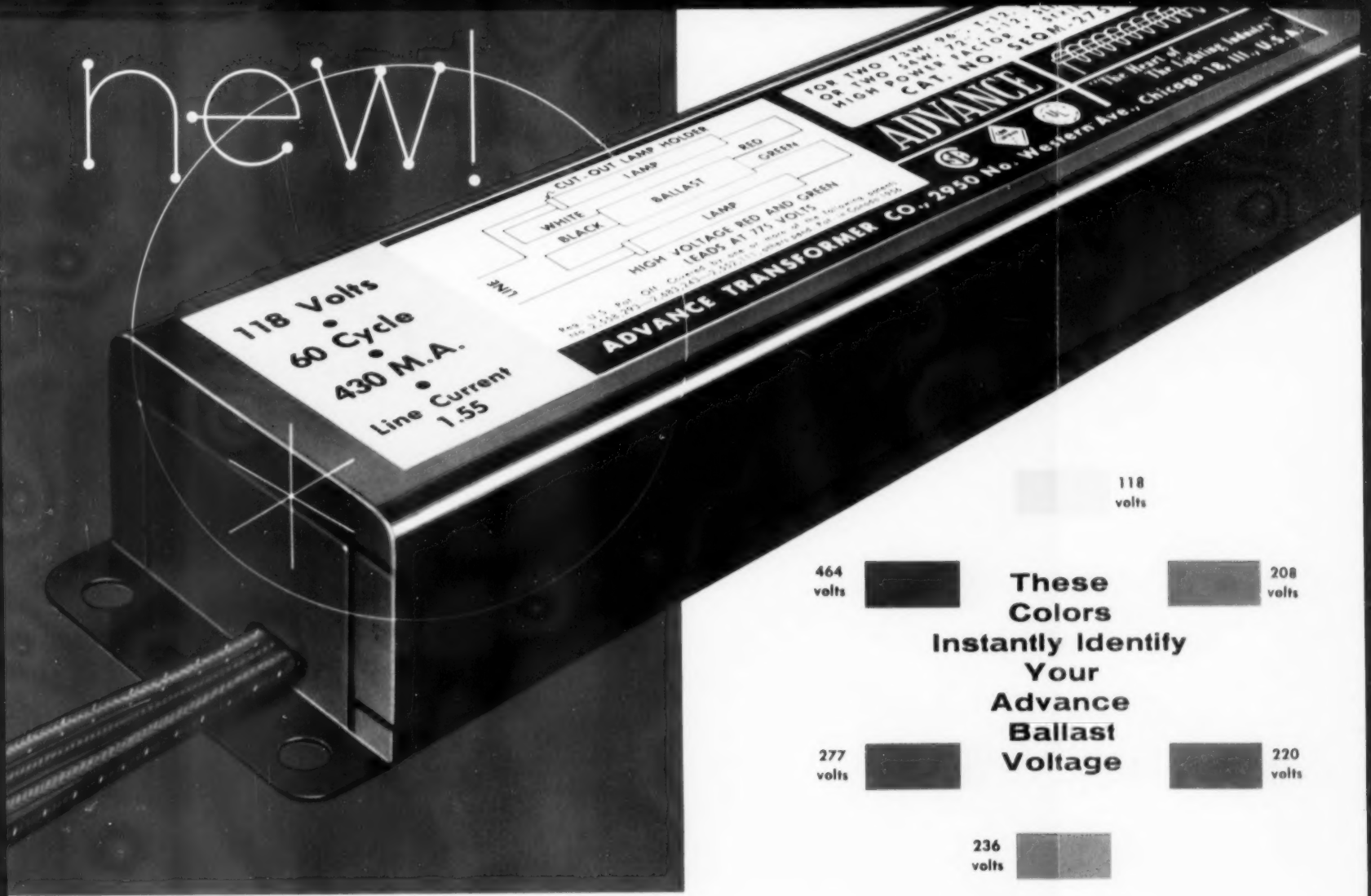
☐ How to cut costs and land more jobs ☐ Trouble-shooting electric motors ☐ How to boost service profits ☐ Electrical servicing of hermetic units

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____



118 volts

464 volts

208 volts

These Colors Instantly Identify Your Advance Ballast Voltage

277 volts

220 volts

236 volts

ADVANCE VISA VOLT®

Now, Advance Transformer Company brings you VISA-VOLT® . . . color coded fluorescent lamp ballasts for instant, positive voltage identification. VISA-VOLT®, another first for the world's largest exclusive manufacturer of fluorescent lamp ballasts, does away with uncertainties by clearly defining circuit voltage, line current, lamp current and other pertinent electrical data. VISA-VOLT® is your assurance that the correct ballast is being utilized in a specific lighting installation.

Insist on VISA-VOLT® color coding and eliminate costly guess work in your next fluorescent lighting installation. VISA-VOLT® color panels are keyed:

YELLOW—118 VOLTS
TAN—208 VOLTS
GREEN—220 VOLTS
ORANGE—236 VOLTS
RED—277 VOLTS
BLUE—464 VOLTS

Start today to enjoy the many advantages of Advance quality fluorescent lamp ballasts . . . ballasts which provide longer life, quieter operation, higher light output, trouble free operation, CBM certification . . . fluorescent lamp ballasts which are guaranteed and continue to serve as "The Heart of the Lighting Industry".

ADVANCE TRANSFORMER CO.

CBM CERTIFIED

World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

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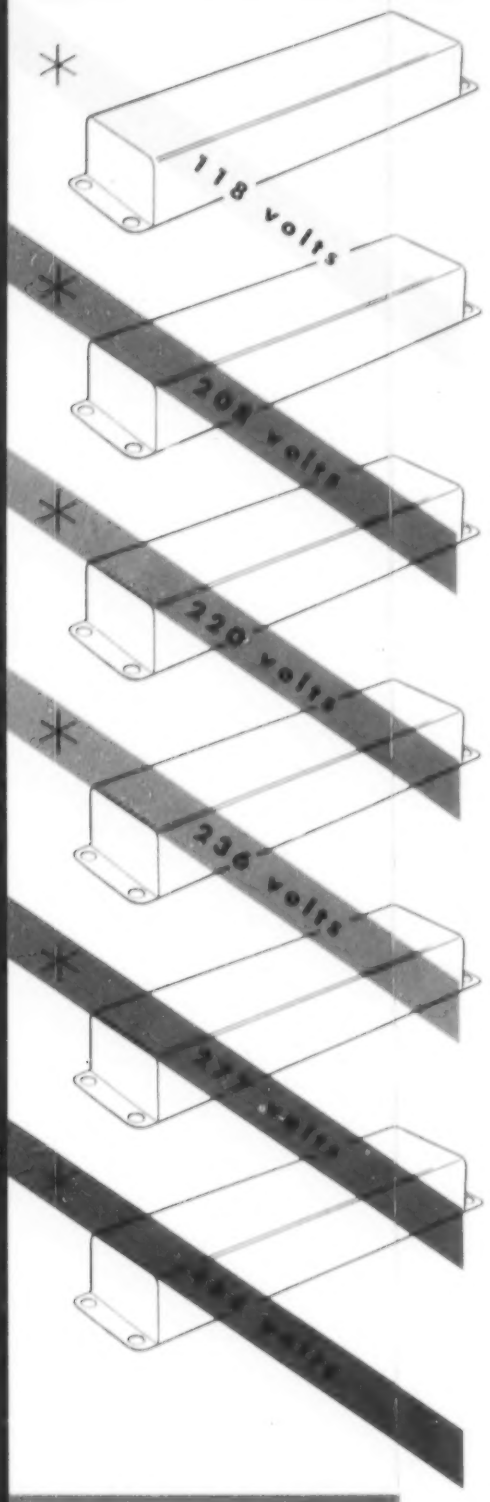
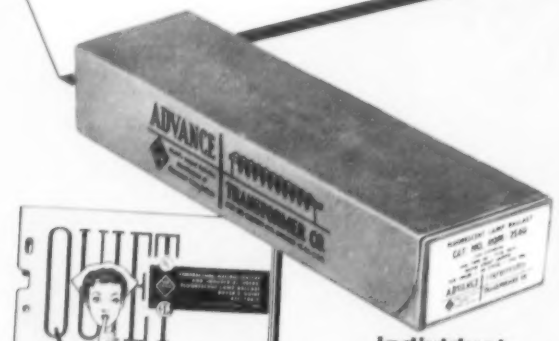


by these colors
instantly identify
your ADVANCE
Ballast Voltage

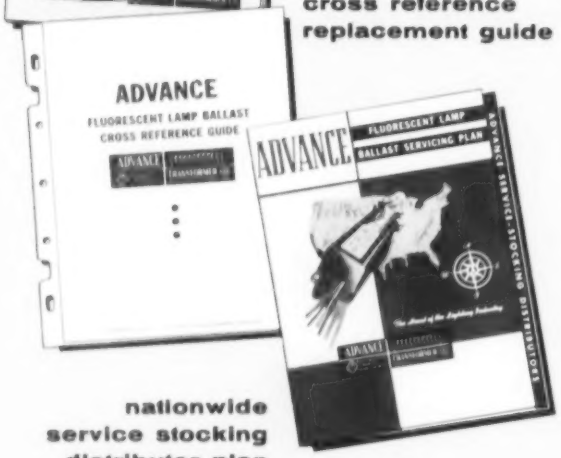
only the world's largest exclusive fluorescent lamp ballast manufacturer offers all this!



individual packaging

buyer's guide

cross reference replacement guide



nationwide service stocking distributor plan

ADVANCE TRANSFORMER CO.
World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts
2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

Through outstanding engineering developments and modern manufacturing facilities, ADVANCE TRANSFORMER COMPANY has become the world's largest manufacturer devoted exclusively to the production of quality fluorescent lamp ballasts. These precision built, power regulating instruments supply exacting amounts of electrical energy for the efficient operation of all fluorescent lamps and are aptly called "THE HEART OF THE LIGHTING INDUSTRY."

Continuing research and constant new developments in both engineering and manufacturing divisions have made possible the introduction of many new ballasts with exclusive patented features. Thus, ADVANCE provides lighting equipment manufacturers, designers, architects, engineers, contractors and other fluorescent lamp ballast users the world's most extensive line of fluorescent lamp ballasts. When you use ADVANCE, there is a ballast for every specific purpose, never a need to compromise.

ADVANCE ballasts are listed by Underwriters' Laboratories, Inc., meet the Canadian Standards Association requirements and many meet or exceed Certified Ballast Manufacturers' specifications. Specify ADVANCE to be sure to get the ballasts with the "plus factors" that have built the world's largest company devoted exclusively to the manufacture of fluorescent lamp ballasts.

The Advance Transformer Company will replace, at no charge, any ADVANCE fluorescent lamp ballast which becomes inoperative within two years from date of manufacture, provided the conditions of ballast operation have conformed to the company's recommendations and the inoperative ballast is returned to an authorized ADVANCE Service-Stocking Distributor.

For anyone who manufactures, specifies, installs or uses fluorescent lighting, ADVANCE TRANSFORMER COMPANY has prepared helpful literature which will be sent without cost or obligation. You may receive a copy of one or all of these brochures by mailing the coupon below.

MAIL THIS NOW!

ADVANCE TRANSFORMER CO.
2950 No. Western Ave., Chicago 18, Illinois

GENTLEMEN: Please send free literature indicated below.

☐ Buyer's Guide
☐ Cross Reference Guide
☐ Service Stocking Distributor Plan

Company _____

Name _____

Address _____

City _____ Zone _____ State _____

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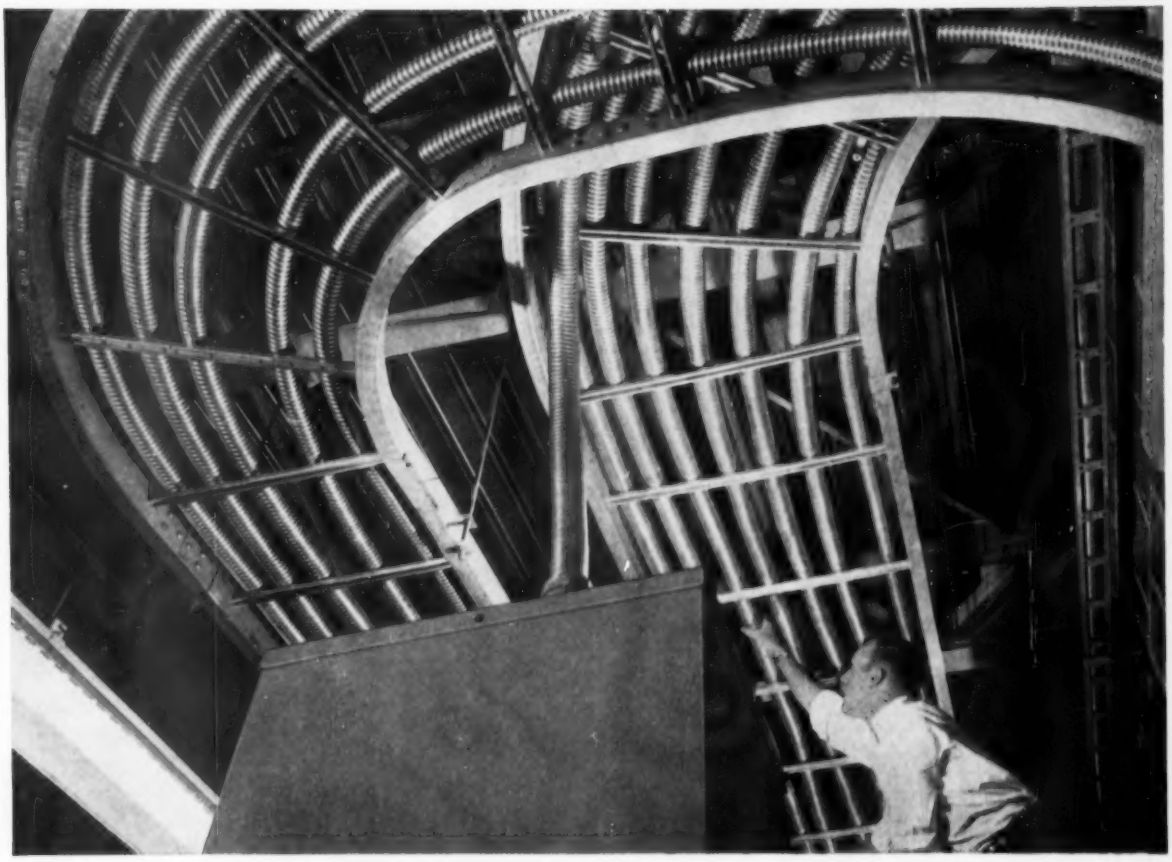


Handle more jobs — speed up installations with General Electric

INTERLOCKED ARMOR CABLE SYSTEMS

You can increase your job capacity with General Electric interlocked armor cables because your crew can install complete power distribution systems faster than with old conventional wiring methods. These highly flexible cables can be pulled easily around corners and over beams, in long unbroken runs, both indoors and out. The supporting racks, baskets or troughs are low in cost and easily erected. Where cable splicing is necessary, a simple mechanical joint does the job. Furthermore, these G-E interlocked armor cable systems eliminate the need for detailed engineering layouts and prefitting—enable you to handle more jobs in your work schedule.

Three types of General Electric interlocked armor cable cover most applications:

1. Varnished-cambric type—for general-purpose duty in dry locations.
2. Varnished-cambric type with special protective polyvinyl chloride jacket under the armor—for *both* interior and exterior locations above grade and in moist atmospheres.
3. Super Coronol* Geoprene* type—for wet and dry locations—can be run directly through underground ducts without potheads at the terminations.

General Electric interlocked armor cable is also available with thermoplastic, silicone rubber, and asbestos insulations, and with galvanized steel, aluminum, and bronze armor. All can be supplied with polyvinyl chloride covering over the armor (in any of several colors) for corrosive areas or circuit identification.

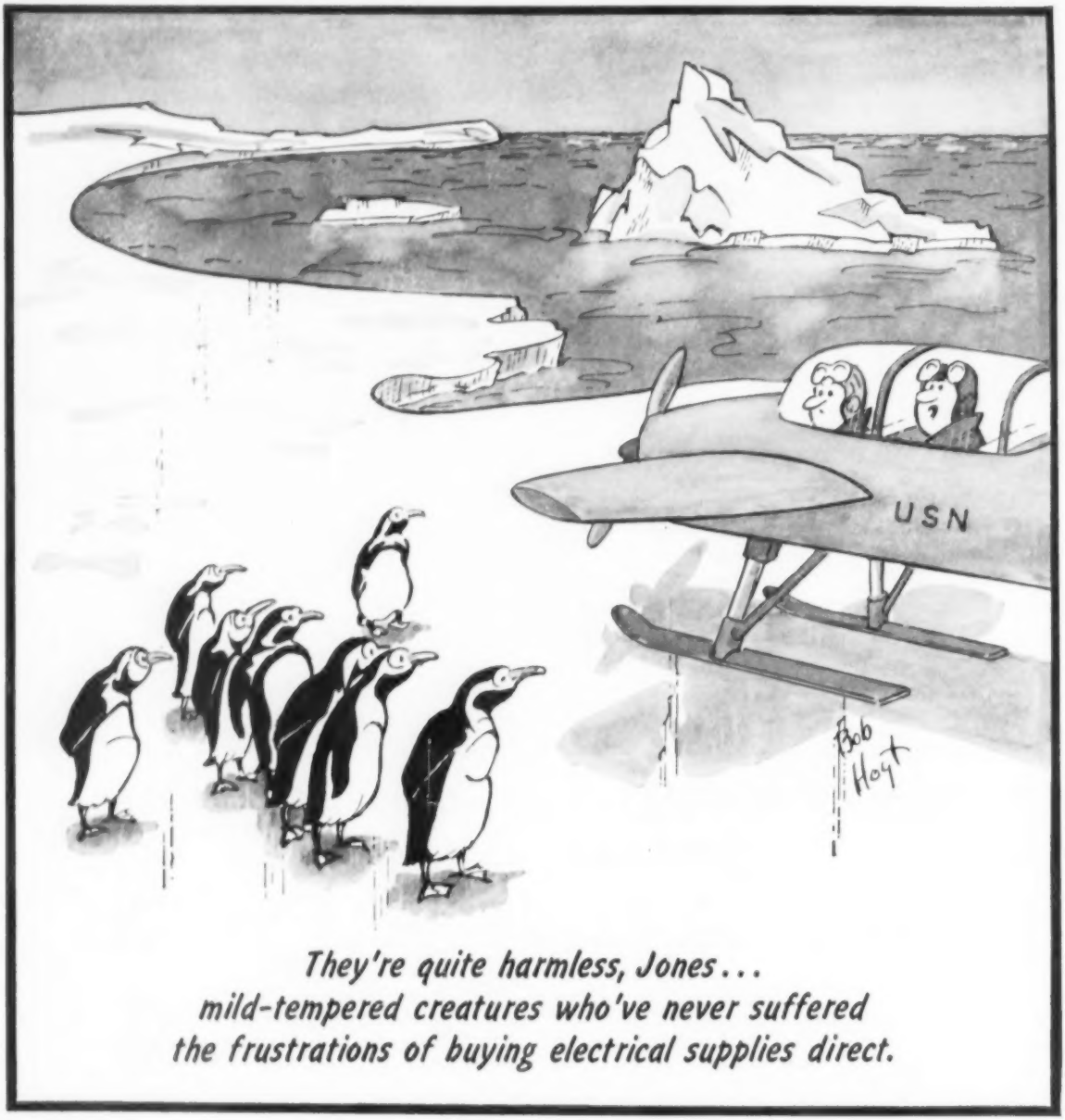
*Registered Trade-mark General Electric Company

For more information, write for your copy of "G-E Interlocked Armor Cable." Address: Section W196-318, Wire & Cable Department, General Electric Company, Bridgeport 2, Connecticut.

Progress Is Our Most Important Product

GENERAL ELECTRIC

One in a series to emphasize the economy of Electrical Wholesale Distribution



They're quite harmless, Jones...
mild-tempered creatures who've never suffered
the frustrations of buying electrical supplies direct.

"Electrical Wholesaler Distribution reduces the Manufacturer's selling cost and thereby reduces the selling price of electrical supply material to the user. Therefore, our policy has been to distribute Thomas & Betts products exclusively through the Electrical Wholesaler."*

LOOK FOR THIS SIGN — AUTHORIZED DISTRIBUTION T&B ENGINEERED IT'S THE MARK OF AN AUTHORIZED **T&B** DISTRIBUTOR

THE THOMAS & BETTS CO.
INCORPORATED
34 BUTLER STREET, ELIZABETH 1, NEW JERSEY
THOMAS & BETTS, LTD., MONTREAL, P. Q., CANADA
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

*Quoted from the T & B Plan of Wholesaler Distribution. If you would like to know the complete story of the T & B Plan, write:

"No. 1" on Wall Street

Towering high above New York's swarming financial district, this familiar 50-story landmark has held sway at "No. 1 Wall Street" since 1931.

Every day some 32,000 passengers speed up and down its 654-foot length – carried swiftly and surely by 28 Otis elevators.

These elevators are now being converted from signal operation to the new Autotronic operatorless system – and will require an entire rewiring job.

Almost 2 million feet of line are needed to wire the control and signal circuits. The wire chosen for this important job in one of America's important buildings was made by Circle – one of the country's largest producers of building wire and cable.

You too can specify and install Circle wire and cable with complete confidence in its quality and dependability. Circle Wire and Cable Corp., 5500 Maspeth Ave., Maspeth, N. Y. (Dept. A3)

• New Wiring Calculator — FREE!

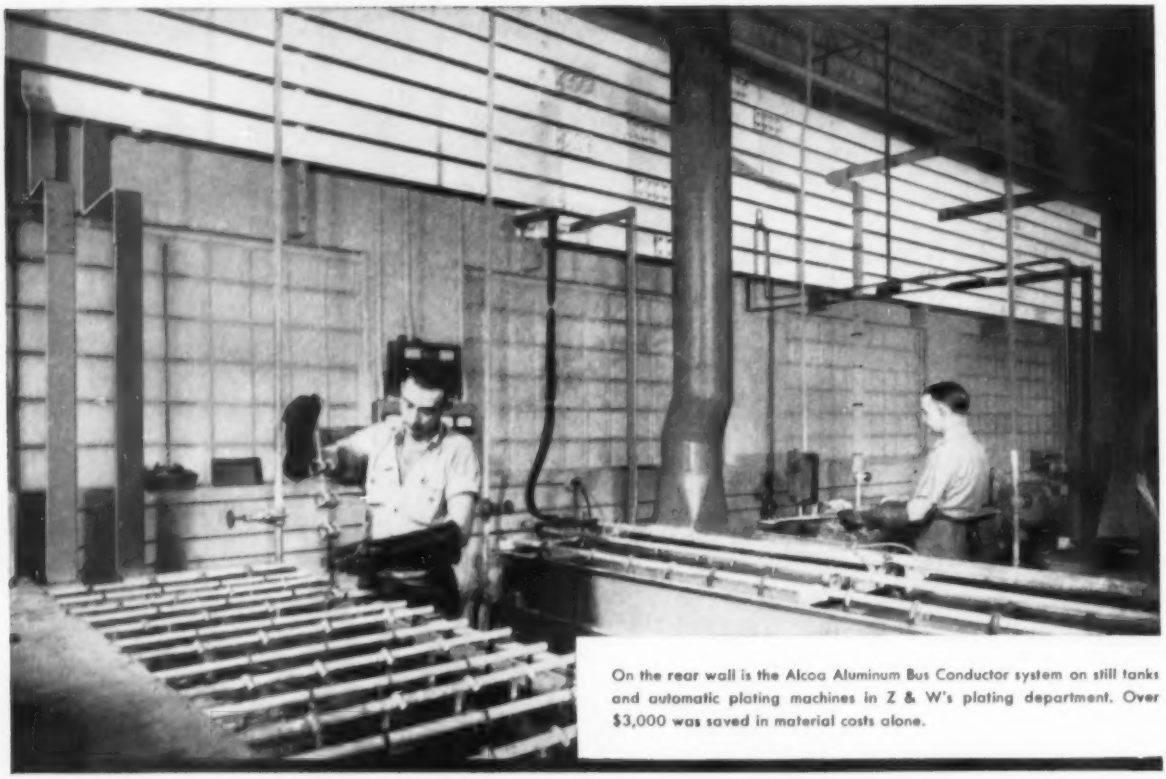
Send today for this handy, useful wiring aid. Gives conduit sizes, amperage capacities, and helpful motor running data.

CIRCLE

WIRE & CABLE

a subsidiary of **CERRO DE PASCO CORPORATION**

PLANTS: Maspeth and Hicksville, N.Y. **SALES OFFICES:** In all principal cities.
RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES
PLASTIC INSULATED CABLES • NEOPRENE SHEATHED CABLES



On the rear wall is the Alcoa Aluminum Bus Conductor system on still tanks and automatic plating machines in Z & W's plating department. Over $3,000 was saved in material costs alone.

$3,000 IN DIRECT SAVINGS

With Alcoa Aluminum Bus Conductor at Z & W Manufacturing

When Z & W Manufacturing Corporation designed their new 130,000 sq ft plant in Wickliffe, Ohio, they wanted equipment second to none—yet costs were closely watched. One of the best of the money-saving acts took place in their plating department.

After a detailed study, they used Alcoa® Aluminum Bus Conductor to carry the 12,000-amp load from individual rectifiers to the six plating lines. Compared to a copper system Z & W got the same conductivity from half as many pounds of metal. Only difference was a slight increase in size. In installing a system using high-conductivity aluminum alloy, Z & W estimates they saved more than $3,000 in direct material costs alone.

Easy fabrication and installation

Other important benefits and savings resulted from aluminum's light weight and easy handling. Also important was the ease of fabrication during their bending and drilling operations. The ½″ x 6″ bars were just bolted to 2 x 8's attached to the wall. Simple insulating washers and wood spacers were used.

Having some small copper bar stock on hand, they used that as leads in some places—other leads were aluminum. Trouble-free joints between copper and aluminum were made, as were all joints, with Alcoa Electrical Joint Compound and aluminum bolts.

Saves 50% on bus conductor

The same technical advice and assistance from Alcoa that enabled Z & W to engineer, design, fabricate and install this bus system are yours for the asking. Study how much you could save with Alcoa Bus Conductor—for expansion or modernization. Cost is about half. Just check the Yellow Pages of your phone book under "Aluminum" for Alcoa's nearest office. Or write, Aluminum Company of America, 2302-C, Alcoa Building, Pittsburgh 19, Pa.

Your Guide to the Best in Aluminum Value

Now available from your jobber!

Reg. U.S. Pat. Off.

SCOTCHLOK Type R

BRAND

Electrical Spring Connectors

With "live" Spring Action!

The "live" spring action of new "SCOTCHLOK" Type R Connectors holds wires in a bulldog grip. The *feel* of turning on a "SCOTCHLOK" is a sound test of its holding power. Here's everything you need for a one-step pig-tail: positive, vibration-proof connection; reinforcing steel shell; tough, pre-insulated vinyl cover; and a neat, compact splice.

FEEL THE GRIP! TRY TO PULL THEM OFF!

Send For Free Samples! See for yourself how good "SCOTCHLOK" Brand Type R Connectors really are! Just write on your letterhead and we'll send you free samples for testing. Address: 3M Company, St. Paul 6, Minn., Dept. CB-37

The term "SCOTCHLOK" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N. Y. In Canada: P. O. Box 757, London, Ontario.

Reduce maintenance 20% with

MORE TRANSFORMERS*

SEALED DRY-TYPE transformers, rated 300 to 2000 kva, 15 kv and below, are virtually maintenance free. Ideal where atmospheric problems exist.

General Electric RM medium transformers

If your new or modernized plant power system calls for transformers 501 to 7500 kva, 69 kv and below, you'll benefit from reduced maintenance on General Electric RM (Repetitive Manufacture) medium transformers.

These G-E features have helped owners cut transformer maintenance time and costs 20 percent and more:

Control-center arrangement of instruments and gages makes them easier to read, easier to service.

Full drain permits sampling of oil from the very bottom of the tank, where water or sediment could collect. This allows less frequent, more complete inspections.

Super Melaglyp finish gives you up to 150% longer paint life. A spray-on can is furnished with each transformer so you can touch-up, prevent rust spots.

MORE RM MEDIUM TRANSFORMER BENEFITS:

Reduced maintenance is only one of the outstanding benefits you'll receive. Here are more:

Faster, less expensive installation—shipped completely assembled, RM medium transformers have features such as ski-tip bases, extra jacking space, and reversible junction boxes which can cut installation time to only four hours.

Shorter shipments—standardization of design and General Electric's repetitive manufacture process cut shipping time to 10 weeks. Voltage ratings and optional features available make these standard units ideal for most industrial applications.

Before you buy a medium transformer, contact your nearest General Electric Apparatus Sales Office. You'll discover how faster shipment, easier installation, reduced maintenance, and longer life add up to more for your transformer dollar. General Electric Company, Schenectady 5, New York. 416-14

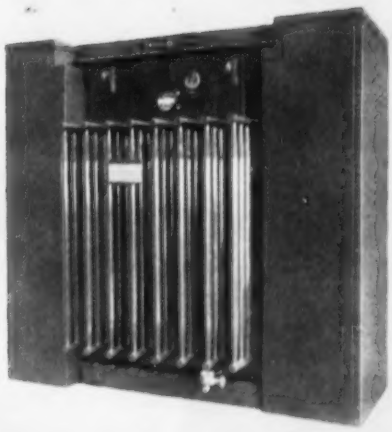
Progress Is Our Most Important Product

GENERAL ELECTRIC

FOR INDUSTRIAL USE FROM THE COMPLETE GENERAL ELECTRIC LINE

OPEN DRY-TYPE transformers, rated 300 to 2000 kva, 15 kv and below, are used in clean, dry, indoor locations where weight or floor space present problems. Light enough to mount overhead!

* These same transformers are also incorporated in General Electric's outstanding line of load-center and distribution-center unit substations.



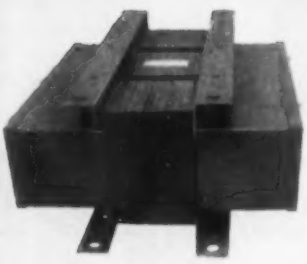
LIQUID-FILLED transformers, rated 112½ to 500 kva, 15 kv and below, conveniently and economically supply small blocks of power. Outdoor units are oil-filled; indoor, Pyranol† filled.

† *Reg. Trade mark of General Electric Company.*

THE NEW EXTENDED LINE of General Electric dry-type M transformers features the newly designed Type M three-phase unit, shown above, equipped with universal mounting bars for all-position mounting. New low noise level allows close proximity installation. Unit is small, light, and easy to install; is available in ratings up to and including 150 kva.

G-E SINGLE-PHASE Type M transformers, known throughout the industry for their reliable, time-proven design, are now available in ratings up to 50 kva. Lifting eyes, sturdy mounting brackets, and keyhole brackets at top help make installation easy.

MOUNTS IN ANY POSITION ... See for yourself the many ways in which the new G-E Type M three-phase transformer can be



General Electric Announces . . .

NEW LOW NOISE LEVEL DRY-TYPE M TRANSFORMERS

- **Available from stock**
- **Designed for commercial building applications**
- **Extended to include ratings up to 50 kva, single-phase and 150 kva, three-phase**

General Electric Type M transformers, long recognized for their high quality and inherent low noise level, are now—for the first time—available in ratings up to 150 kva. The new higher kva rated units are designed specifically for commercial building applications requiring low noise level transformers. They are competitively priced and available from stock.

The maximum rating of single-phase units has been extended from 15 to 50 kva. Three-phase units, formerly available in ratings from 3 to 15 kva, are now offered in ratings up to and including 150 kva. Never before has General Electric offered such a wide variety of ratings—3 to 150 kva—in a standard, uniform line of high-quality, low noise level transformers.

LOW NOISE LEVEL

The new higher kva rated units along with all other Type M transformers are designed for a noise level of 45 decibels or below. This low noise level enables you to meet most noise specifications for commercial building applications such as offices, motels, apartment houses, and schools where quiet operation is essential.

EASY TO MOUNT

The new higher rated Type M three-phase units with exposed core construction are smaller and thinner than previous encased designs in comparable ratings. Also, they are equipped with universal mounting bars for easy mounting in almost any position *right at the load*. Single-phase units feature lifting eyes, sturdy mounting brackets, and keyhole brackets at the top to facilitate installation.

OTHER TYPE M FEATURES

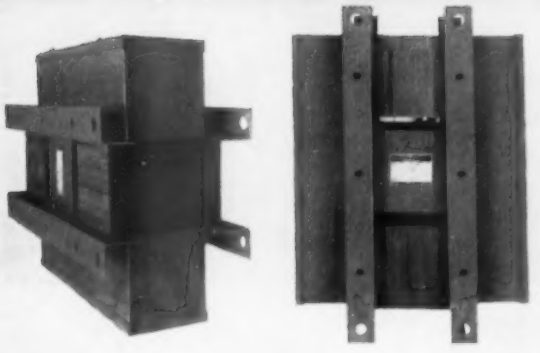
Other features important to specifier, contractor, and user alike include: large exposed core surface for efficient cooling; water- and fire-resisting enamel finish; non-ventilated construction minimizing effect of humidity and foreign particles in the air. Three-phase units feature separate compartments for primary and secondary connections and new Alkanex* coated aluminum wire for longer life and increased reliability.

Call your nearest General Electric distributor today for more information on G.E.'s new extended Type M transformer line. Or, send in the coupon below for your free copy of bulletin GEC-1432 filled with dimensions, wiring diagrams and other useful information.

*Registered trade-mark of General Electric Company.

GENERAL ELECTRIC

mounted—on its side . . . on the wall or floor, upright . . . on its back . . . on the ceiling.



Section A410-45
General Electric Company
Schenectady 5, New York

Please send me a free copy of bulletin GEC-1432 on the new extended line of General Electric Type M transformers.

NAME _____

COMPANY _____

TITLE _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

How General Electric Apparatus Distributors help cut your warehousing costs

Users of electrical equipment can save on space, insurance, handling, inventory costs, and taxes, when they take advantage of General Electric Apparatus Distributors' services.

DELIVERY AT A MOMENT'S NOTICE — The General Electric distributor's warehouse is stocked to handle your apparatus needs. His large inventory, expert staff and efficient handling methods relieve you of many stocking and insurance costs.

Users of electrical apparatus face a triple threat. A warehouse full of the tools and equipment needed for production usually represents a capital asset. However, it can easily turn into a liability overnight for these reasons:

1. Loss from the high cost of warehousing stocks. Standard accounting practice places average warehousing costs at 5–10 per cent of total inventory value.

2. Mounting costs in insurance, handling, stocking. Materials handling, equipment, personnel, fire and sprinkler insurance on physical inventory go to swell the over-all cost of production.

3. Loss through obsolescence. As the electrical industry continues to improve and develop new and better equipment, users must be ready to take immediate advantage of this equipment without having to exhaust heavy inventories.

Here's how the General Electric Apparatus Distributor helps you eliminate much of this cost:

1. His large warehouse releases your storage areas for production. With the cost of new footage in plants rising steadily, use of the electrical distributor's warehouse can eliminate the need for new construction by freeing storage areas for production.

MANY "SHELF GOODS" ITEMS are immediately available at G-E distributor counters.

RAPID CUSTOMER SERVICE is assured by central stock control. The General Electric distributor has many thousands of electrical items available from his warehouse stock.

2. He saves you handling, stocking and insurance costs. The distributor's expert staff, his extensive sources of supply, his specialized handling facilities help eliminate many of your stocking costs. One-stop shopping for all your electrical needs means a saving in time and money.

3. The distributor helps eliminate the danger of obsolescent stocks. An important part of the distributor's function is assuming the risk for obsolescent stock. No matter when or how often you order, you are sure of getting the latest electrical equipment, and the technical assistance that goes with it.

In addition, your distributor is set up to give you fast delivery on both standard and hard-to-get items. Normally, the distributor makes it his business to stock the items his customers are likely to need. In emergencies, he can supply special equipment in a hurry.

To make the most of your distributor's services, have a talk with him; let him show you how to capitalize on his training, experience, and facilities. If you don't know your G-E distributor's name, write National Manager, Distributor Sales, General Electric Company, Schenectady 5, N. Y.

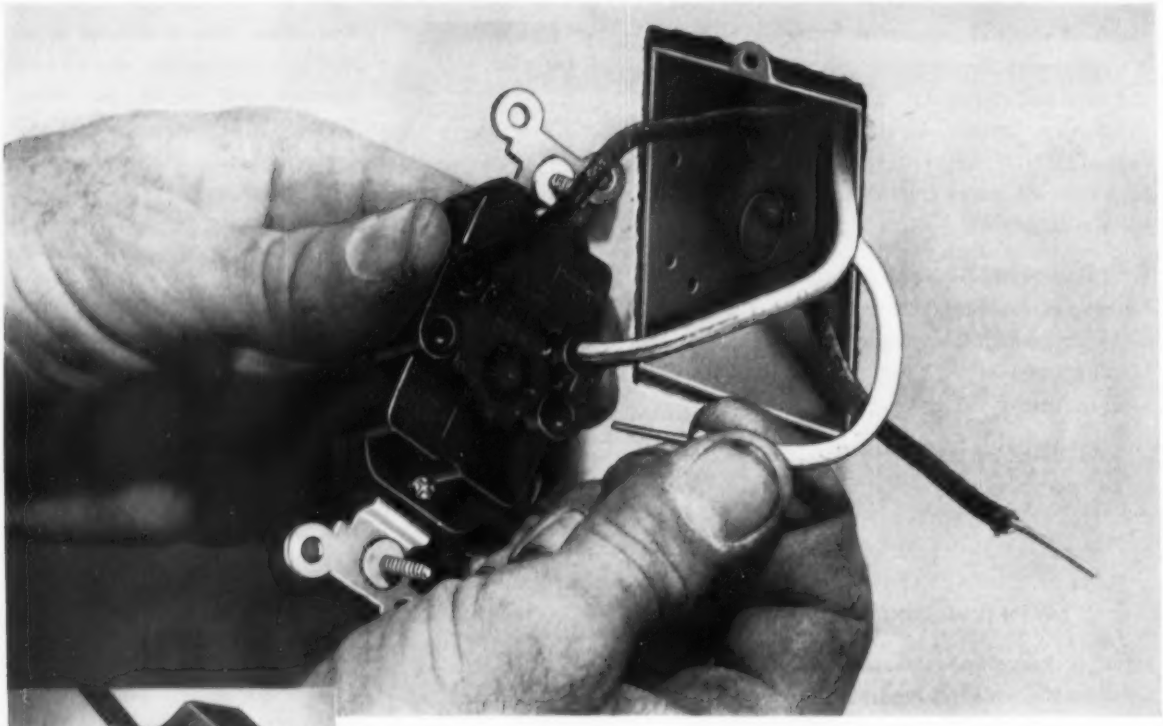
340-33

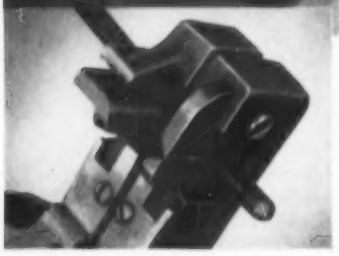
These Are Some of the Products Sold by General Electric Apparatus Agents and Distributors

- fractional-hp motors
- 1–5-hp integral motors
- gear motors ¼ to 100 hp
- distribution and power transformers
- arresters
- cutouts
- push buttons
- manual and magnetic starters
- relays and solenoids
- electric instruments
- time switches
- heaters and soldering irons
- watthour meters and sockets
- air circuit breakers
- switchgear
- rectifiers
- capacitors
- substations
- inductrol voltage regulators

Progress Is Our Most Important Product

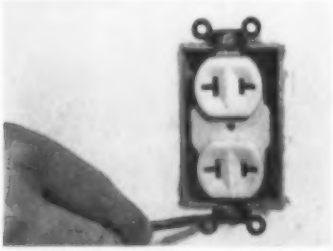
GENERAL ELECTRIC





JUST STRIP WIRE to length shown on strip gage. (For your convenience, there's a strip gage on every device.)

PUSH WIRE INTO HOLE — strong spring automatically locks conductor in terminal channel — withstands 75 lb. pull.



MOUNTING SCREWS — a much overlooked time saver, have self-tapping, plaster cleaning threads . . . are held in position by fiber washers for quick installation.

MAKE TIME FOR MORE JOBS

by using General Electric switches and outlets with pressure-lock terminals

General Electric switches and outlets with pressure-lock terminals eliminate the need for looping wires, and fussing with binding screws . . . make wiring installations faster and more profitable . . . permit time for additional jobs.

They allow you to make better installations, too, by locking conductors in firm mechanical connections assuring positive electrical contacts even when devices are turned, pulled or pushed. Possibility of wasting time by looking for shorts in outlet boxes is virtually eliminated because terminals are completely insulated and enclosed.

G-E devices with pressure-lock terminals take solid copper conductors in sizes 14, 12 and 10 AWG and stranded conductors in sizes 14 and 12 AWG. See your nearest G-E distributor today . . . ask him to demonstrate and tell you more about the complete line of competitively priced General Electric wiring devices with pressure-lock terminals. At prices he will quote, you'll find it profitable to use them on your next wiring job. Wiring Device Department, General Electric Company, Providence 7, R. I.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Jacksonville, Fla.

Birmingham, Ala.

Bristol, Tenn.

Richmond, Va.

THE "GENERAL" ADDS TEN NEW STARS

Atlanta, Georgia
Baltimore, Maryland
Boston, Massachusetts
Chicago, Illinois
Cincinnati, Ohio
Cleveland, Ohio
Dallas, Texas
Dayton, Ohio
Denver, Colorado
Detroit, Michigan
Greensboro, North Carolina
Indianapolis, Indiana
Kansas City, Missouri
Lincoln, Nebraska
Los Angeles, California

Memphis, Tennessee
Milwaukee, Wisconsin
Minneapolis, Minnesota
Newark, New Jersey
New Haven, Connecticut
New Orleans, Louisiana
Philadelphia, Pennsylvania
Pittsburgh, Pennsylvania
Portland, Oregon
St. Louis, Missouri
San Francisco, California
Seattle, Washington
Springfield, Illinois
Syracuse, New York
Tampa, Florida

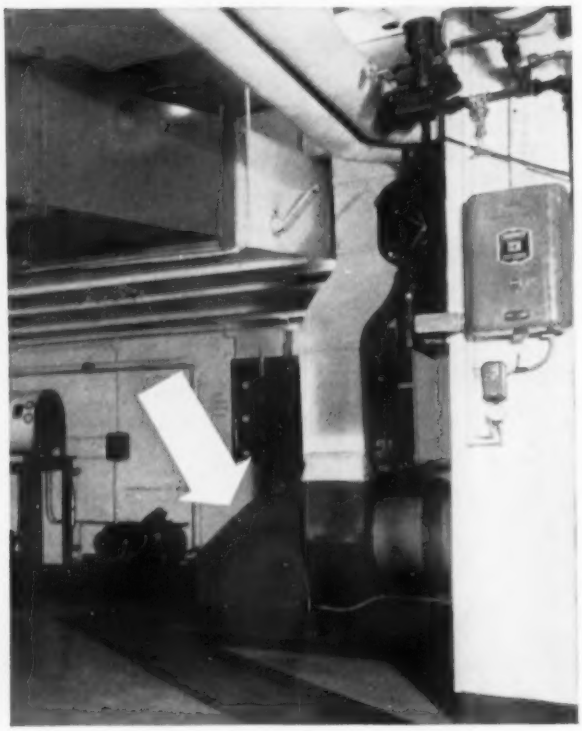
Backing up our Authorized Distributors' stocks, General Cable now adds 10 New Distributing Centers to its nationwide operation. Now, to keep pace with soaring demands, there will be 40 General Cable Distributing Centers fully stocked to meet our Authorized Distributors' wire and cable requirements.

Rely on General Cable's Authorized Distributor stocks for superior quality, unequalled service and availability for all your wire and cable needs.

GENERAL CABLE CORPORATION
420 Lexington Avenue, New York 17, New York
Offices and Distribution Centers Coast-to-Coast.

***for quality and service...specify* GENERAL CABLE**

FROM TELEPHONE BOOTHS . . . TO INDUSTRIAL PLANTS



. . . here's the most versatile package unit that ever solved a ventilating problem!

American Blower Utility Set

We call them utility sets because they handle such a wide variety of ventilating problems.

Self-contained, American Blower Utility Sets, in a wide range of sizes and capacities, are used to supply or exhaust air in a wide variety of applications requiring a duct system. That means from small-capacity driers, laboratory exhaust systems, to the supply and exhaust requirements in hard-to-reach areas of public buildings, apartments, schools, hospitals, or industrial plants.

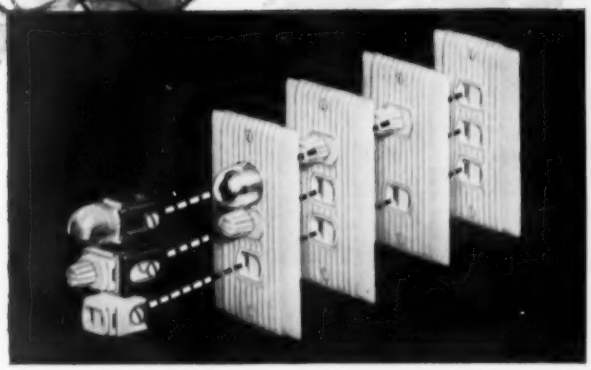
As individual package units, they are easy to install, economical to operate. And they're engineered by American Blower—specialists in the design and manufacture of air-handling and air-conditioning equipment for over 75 years. Call our nearest branch office today for full information; or write: American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of AMERICAN-Standard

P&S

the original DESPARD® line



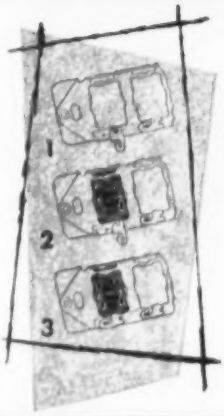
QUALITY *is your most important specification*

When you specify the original P&S Despard Line, you specify the *finest quality* in wiring devices today.

Introduced in 1932, now backed by 25 years of constant improvement, the P&S Despard Line is *first choice* with contractor—with wholesaler—with builder. It adds to *your* reputation for offering only the best.

P&S Despard combinations of two or three switches (exclusive Roto-Glo®, residential and T-rated toggle type), outlets, and special devices are *assembled on the job*—in a matter of seconds. *Installation requires no change in basic wiring habits.* Combinations fit in a one-gang standard size plate. Accurately engineered . . . produced with precision . . . the P&S Despard Line gives you dependable, trouble-free performance for the life of the building.

Remember—the original always beats the imitation! For full information, see your nearest P&S distributor or write us direct to Dept. ECM-24.



It's simple—quick—easy to assemble these P&S Despard combinations. (1) Open cam . . . (2) insert device . . . (3) close cam! Just turning the cam with your fingers locks device securely in mounting strap; no screwdriver needed.

P&S®

PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK
60 E. 42nd St., New York 17, N. Y. 1229 W. Washington Blvd., Chicago 7, Ill.
In Canada; Renfrew Elec. & Refrig. Co., Ltd., Renfrew, Ontario

MAKE THE COMPLETE JOB *COMPLETELY* P&S

MEN RESPONSIBLE FOR

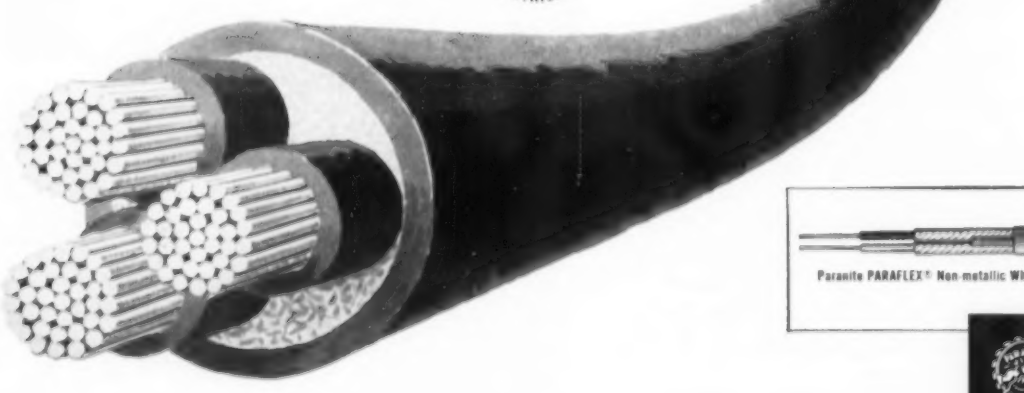
POWER DISTRIBUTION KNOW...

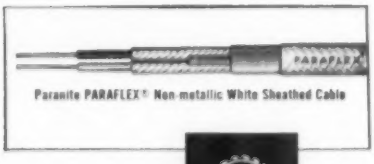
IF IT'S PARANITE IT'S RIGHT!®

FROM POWER CABLE TO FIXTURE WIRE...

Paranite has earned an unquestioned reputation for quality wire products and dependable service! Such well known products as Paranite PARAFLEX® non-metallic white sheathed cable and PARASYN® small diameter building wire have become "tools of the trade" with experienced contractors everywhere! On your next installation . . . specify PARANITE® for a wire of proven performance.

LIVE BETTER ELECTRICALLY





Paranite PARAFLEX® Non-metallic White Sheathed Cable

PARANITE WIRE AND CABLE

DIVISION ESSEX WIRE CORPORATION

FORT WAYNE 6, INDIANA

MANUFACTURING PLANTS: ***Birmingham, Alabama; Anaheim, California; Jonesboro, Indiana; Marion, Indiana; Tiffin, Ohio**

Warehouses* and Sales Offices

*Chicago, Illinois	Hartford, Connecticut	*Newark, New Jersey	Rochester, New York
Cleveland, Ohio	Indianapolis, Indiana	Omaha, Nebraska	*Saint Louis, Missouri
Dallas, Texas	*Kansas City, Missouri	*Portland, Oregon	*San Francisco, California
*Detroit, Michigan	*Los Angeles, California	Upper Darby (Philadelphia), Pa.	Springfield, Illinois

GEDNEY'S RIGHT THERE IN YOUR CORNER

helping save time . . . hold down costs

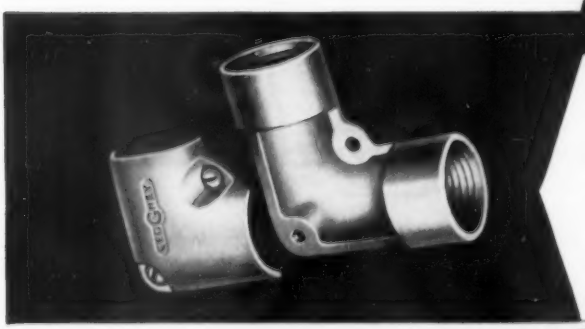
CORNER FITTINGS? Well, here are three that have proved immensely popular for the simple reason they're easiest to install – save time and labor that really counts up. Like the rest of the full Gedney line they're made of unbreakable malleable iron...accurately machined and threaded... individually inspected. Order Gedney – always – for lowest installed costs!

90° CORNER ELLS

Fitted with gasketed cover. Both ends female. Made of malleable iron, cadmium plated. Available in a full range of sizes from ½" to 2".

90° CORNER ADAPTERS

Fitted with gasketed cover. One end male, one end female. Made of malleable iron, cadmium plated. Your choice of sizes from ½" to 2".



CORNER PULL-IN CONDUIT ELLS

Today's top specification for space-saving, machine wiring, easy wire pulling. Malleable iron, cadmium plated. Sizes run from ½" to 2".

GEDNEY FITTINGS FIT

GEDNEY
ELECTRIC COMPANY

GEDNEY

RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

Mr. M. S. Buttner, M. S. Buttner Sons, Inc., Baltimore, Md.

DECIDEDLY BETTER
DAY-BRITE
Lighting Fixtures

"One-third lighter...easy to install"

"The new Day-Brite shallow troffers are the best yet. They are one-third lighter in weight—are easy to handle on the job and are easy to install.

"What's more, they come to the job as a complete package. Each carton contains all the necessary mounting accessories. There's no on-the-job assembly—and they're tailored to fit any type ceiling."

Mr. Buttner realizes how much installation costs him. We know he likes the low cost and distinctive appearance of the new Day-Brite shallow troffer, but he is most impressed with the time it saves on the job.

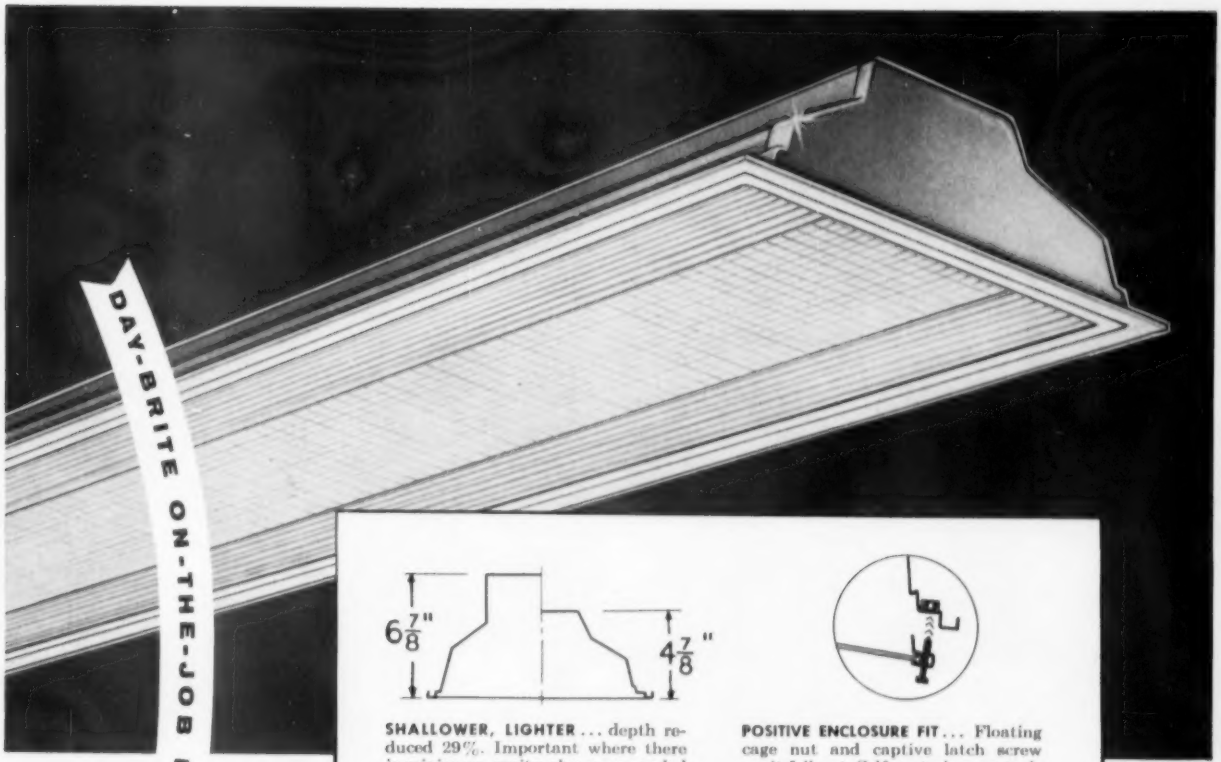
More and more contractors are looking first to Day-Brite for the lighting equipment they want. Especially contractors who realize that it's the installation time that decides their profit. Does that include you?

DAY-BRITE LIGHTING, INC. • 5402 Bulwer Avenue, St. Louis, Missouri
Day-Brite Lighting, Inc., of California • 530 Martin Ave., Santa Clara, Calif.

Certified Lighting for a Better America

71114

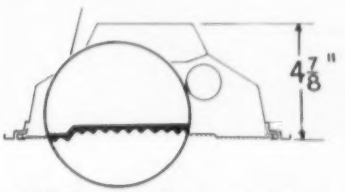
NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING FIXTURES



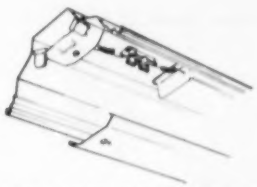
DAY-BRITE ON-THE-JOB MAKES THE BIG DIFFERENCE HERE

SHALLOWER, LIGHTER ... depth reduced 29%. Important where there is minimum cavity above suspended ceiling plane. 33% lighter means easier handling.

POSITIVE ENCLOSURE FIT ... Floating cage nut and captive latch screw can't fall out. Self-centering, no tools required.



MORE BEAUTY, BETTER LIGHTING ... Plastic Cleartex enclosure resists breakage. Long prisms eliminate side glare. Striated, recessed center section controls brightness, increases distinctive appearance.



QUICK, EASY MAINTENANCE ... Fused for safety. Keyhole slots speed removal of wireway cover. Also: enclosure hinges from either side for easy installation and maintenance.

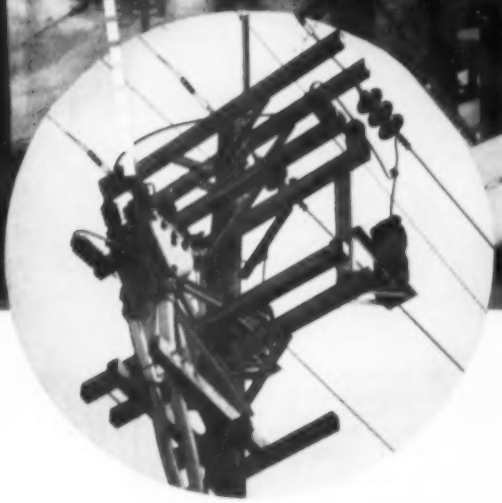
WEEKLY TIME CARD

Name John Smith

Time Card for Week Ending March, 12 195 7

Job No. 123 Job Description Third National Bank

HOURS		MON	TUE	WED	THU	FRI	SAT	SUN	
From	To								



new 15kv Loxarmor* circuits eliminate conduit, allow simple terminations

Stainless steel Loxarmor cable was recently chosen by the Petro-Tex Chemical Corporation, jointly owned by Tennessee Gas Transmission Co. and Food Machinery and Chemical Corp., for main feeder circuits in their Houston, Texas plant.

Heart of this system is Okolite insulation applied by Okonite's strip-insulating method. The advantages inherent in the Loxarmor construction add considerably to the basic advantages of the Okolite insulation.

Advantages of Loxarmor construction:

. . . stainless steel armor provides the ultimate resistance to corrosive atmospheres prevalent in petrochemical plants.

. . . reduces installation and maintenance costs because of flexibility and the elimination of rigid conduit. Open type construction permits quick, simple inspection of your electrical system.

. . . completely salvageable—can be reused at will or can be easily re-routed.

. . . standard fittings permit relatively simple terminating procedures.

Petro-Tex Chemical Corporation's use of this construction typifies the modern trend to Loxarmor. Where the maximum security of a rigid conduit is not necessary, Loxarmor is a highly acceptable alternate.

Bulletin -1090 provides a thorough description of Loxarmor, providing engineering information, splicing and terminating drawings and instructions, and a discussion of the various components. Loxarmor power and control cables are available with any of Okonite's strip-insulated and extruded rubber insulations or with varnished cambric and plastic dielectrics. Write for it today to The Okonite Company, Passaic, N. J.

***Okonite's trade name for interlocked S-shaped armor—available in stainless or galvanized steel, aluminum or bronze. Protective coverings can be applied over the armor for special corrosion and chemical resistance.**

4710

where there's electrical power . . . there's **OKONITE CABLE**

The thinnest fixture ever designed with no dark areas

the new Gibson Ceilo•35

This beautiful surface-mount fixture is only 2¾" deep, the thinnest ever designed without panels or strips to conceal the ballasts. In the Ceilo-35, the ballasts are mounted in the sides, an exclusive Gibson development which provides a smooth, unbroken panel of light.

Not only is this new fixture the best-looking you ever saw, it has many new and practical design features to make installation faster and maintenance easier.

,,,

WRITE TODAY FOR COMPLETE INFORMATION

Makers of the world's most versatile fixtures

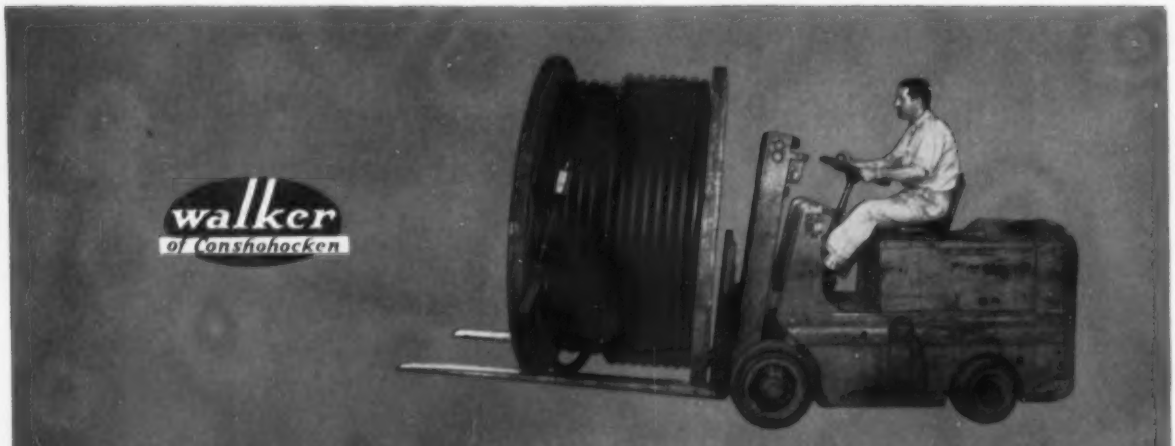
ortho-77® 88®

PAT. PEND.

Gibson LIGHTING

GIBSON Manufacturing Co.

1919 Piedmont Circle, N.E., Atlanta 9, Georgia



walker of Conshohocken

How quality insulation resulted in lower cost cable

This Walker 3 conductor, 500 MCM, 600 volt, Type USE-75°C cable measures slightly over 2½ inches in diameter and is insulated with Type RHW (butyl rubber) insulation. It has color-coded conductors, fibrous fillers, and an 8/64 inch neoprene jacket.

Because of the high temperature rating of Walkerzone (butyl rubber) and the resultant high current carrying capacity, it was possible to use a smaller size of copper and conduit than that which would have been required with RH-RW insulation. This, in turn, resulted in lower cost while affording a cable with excellent resistance to water and aging.

Walker Wire and Cable has earned, over the past quarter of a century, a reputation for high quality insulation. Recently, when Type RHH was included in the 1956 National Electrical Code, Walker's standard RHW insulation contained the extra safety needed to pass the requirements of Underwriters' Laboratories for Type RHH. Walker compounds are always built with that extra unit of quality which means safety and long life.

On your next job, when you recommend, specify or buy wire and cable—remember Walker.

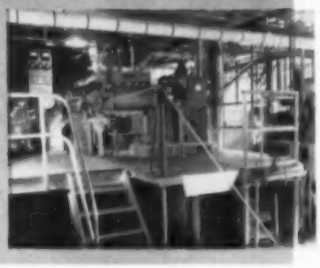
WIRE and CABLE manufactured by WALKER

Power Cable
Control Cable
Street Lighting Cable
Service Entrance
Non-metallic Sheathed Cable
Rubber Covered
Lead Covered
Thermoplastic Insulated
Neoprene Weatherproof
and other types

The Copper Division, Walker Brothers, Conshohocken, Pa.—one of three modern Walker plants which total approximately 500,000 sq. ft.

6-Wire Closing Machine

Extruder and Continuous Vulcanizing Machine

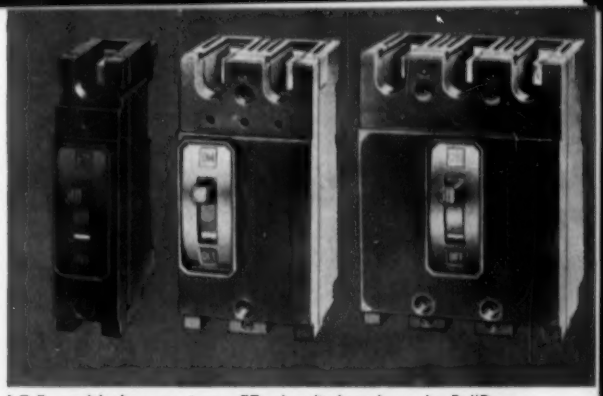


walker of Conshohocken

WALKER BROTHERS

COPPER DIVISION

Conshohocken, Pa.



I-T-E molded case type ET circuit breakers in BullDog power panels become the nerve centers of commercial and industrial buildings. They cover a range of needs, from the 'E' frame 100-amp 1, 2 and 3 pole breakers shown above to 'L' frame 600-amp 2 and 3 pole breakers.

Your BullDog field engineer will be happy to give you all the details on power panels and the many other BullDog electrical products. You'll find that a complete distribution system by BullDog performs with top efficiency and safety . . . brings savings all down the line.

Compact control centers provide two-way protection

Give your customer double protection—install BullDog power panels with I-T-E molded-case circuit breakers. Magnetic, instantaneous trip insures instant protection against shorts, while thermal time delay trip guards against overloads. Where space is at a premium, you can mount them on walls easily, quickly. The breakers meet all needs from 100-amp light-duty to 600-amp heavy-duty service . . . provide unsurpassed overcurrent protection and safely carry continuous rating indefinitely.

I-T-E circuit breakers perform repeatedly with low watts-loss and without replacement of parts, too—features that rate high with your clients and earn repeat business for you. See your BullDog field engineer or electrical distributor for complete details.

© BEPCO

BullDog Electric Products Company, Detroit 32, Michigan • A Division of I-T-E Circuit Breaker Company • *Export Division:* 13 East 40th St., New York 16, N.Y. *In Canada:* BullDog Electric Products Co. (Canada), Limited, 80 Clayson Rd., Toronto 15, Ontario.

IF IT'S NEW . . . IF IT'S DIFFERENT . . . IF IT'S BETTER . . . IT'S

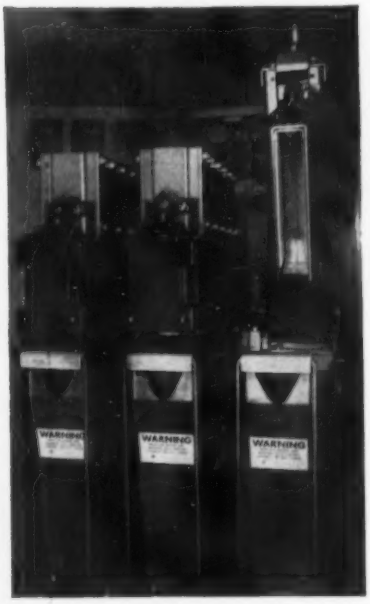
BULLDOG

ELECTRIC PRODUCTS COMPANY

A DIVISION OF I-T-E CIRCUIT BREAKER COMPANY

METAL-CLAD SWITCHGEAR

PURIFIED PORCELAIN in horizontal and vertical bus supports, primary disconnect bushings and caps and epoxy in bus joint covers provide excellent insulation, prevent fires in 15 kv I-T-E metal-clad switchgear.



EPOXY AND SPECIAL CERAMICS protect personnel and equipment by preventing fires in the circuit breaker section. Arc chute rear supports and blowout coils are epoxy. Jump gap cooling plates, arc chute liner plates, arc plates and spacers are special ceramics.

Only the finest fire-protective insulating materials

Nonflammable porcelain and ceramics, flame-resistant epoxy, and other flame-retardant insulating materials throughout, are among the extra values you find in I-T-E Metal-Clad Switchgear. Purified porcelain, of which the primary disconnect bushings and caps are made, also supports both vertical and horizontal bus. It is nonflammable, has high dielectric strength, won't track or deteriorate, is inherently contamination free.

Epoxy, which can be molded into complicated shapes, forms arc chute rear supports, blowout coils, bus joint covers, potential and current transformers. It has high mechanical and dielectric strength, is nontracking and extremely flame resistant.

Special ceramics, highly resistant to direct arc exposure, are used in jump gap cooling plates, arc chute liner plates, arc plates and spacers. These have high dielectric strength, low moisture absorption, won't track, are excellent interrupting materials. They do not deteriorate when subjected to direct arc exposure. They absorb thermal shock and deionize gases without excessive heating.

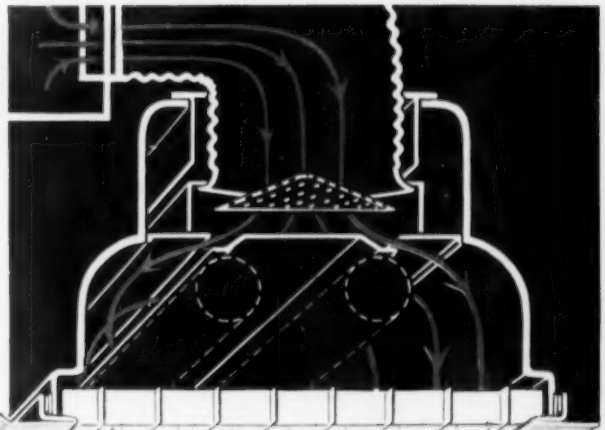
Phenolic and polyester insulating sheets and moldings, specially treated to provide the highest possible degree of flame-retardant characteristics, are also used.

If you are planning new construction or modernization requiring electric power, consider the advantages of I-T-E equipment. Consult your local I-T-E sales office or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES, LTD.

2 in 1



A great improvement in Air Conditioning is born INSIDE a lighting unit! Cold air is efficiently diffused along the entire length of the fixture through the unique Multi-Vent Diffuser Plate. A multitude of vents disperses air along the contour of the reflector, resulting in a gentle downward diffusion of the air for truly draft-free air conditioning.

both LIGHT and AIR from the SAME fixture!

Here is a lighting unit that does something about room temperatures, too! The new 2-in-1 Benjamin Multi-Vent Trofferlite delivers both the most modern illumination and improved air diffusion from the same fixture at a decided cost saving. It brings you well-diffused, adequately-shielded Benjamin-engineered light conditioning, in combination with a new advance in gently-diffused, draft-free air conditioning. Ceilings take on a modern, uncluttered look because air diffusers are concealed inside the clean-lined troffer lighting units. Installation costs dip way down, as the 2-in-1 feature reduces the number and variety of fixtures required. Wherever light and air conditioning are needed, specify Benjamin Multi-Vent Trofferlites to make the job simpler, the design more beautiful, the air conditioning more successful and the cost much lower! Send for FREE illustrated 8-page Data Brochure. Write Benjamin Electric Mfg. Co., Dept. H Des Plaines, Illinois.

Now — Advanced Benjamin Light Conditioning
PLUS Greatly Improved Air Conditioning from one unit!

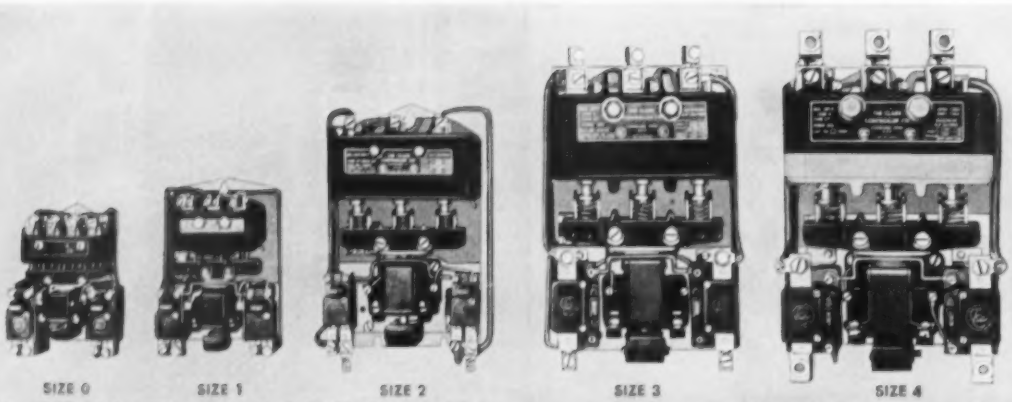
No double installation problems!
Improved draft-free air conditioning!
Benjamin-engineered illumination!
No discord of fixtures!

Certified Lighting

BENJAMIN
MULTI-VENT TROFFERLITE
2-IN-1 LIGHT AND AIR DIFFUSION SYSTEM

Trofferlite by Benjamin Electric Mfg. Co. • Multi-Vent® Air Diffuser by Pyle National Co.

B-1472 S

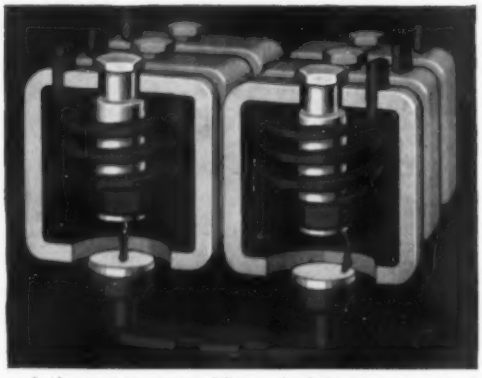


CLARK Type "CY" Starters now available in sizes

0 to 4

With the addition of the new size 4, the famous CLARK line of Type "CY" Magnetic Motor Starters now comprises the full range from 0 to 4. This means that Clark starters of the proven "CY" design incorporating vertical lift magnets are now available for more than 95% of industry's AC requirements. For installations requiring sizes 5 and larger, Clark will continue to supply dependable clapper-type starters.

Clark Type "CY" starters have many outstanding design features for more dependable operation, less maintenance and longer life. For example—rugged construction with twin-break contacts means more trouble-free service . . . contacts can be inspected without tools . . . movable and stationary contacts can be removed and replaced quickly, coils changed and the entire magnet assembly removed—all from the front—without special tools and without removing the starter from the cabinet or panel.



Revolutionary arc-quenching principle is an exclusive feature of all Clark Type "CY" starters sizes 2 and larger. It combines twin-break contacts with strong multi-turn magnetic blowouts which force the arc to rotate—alternately lengthened and confined—so that it moves continuously from a hot to a cold spot on the contact surfaces. This practically eliminates metal build-up or pitting and greatly increases contact life.

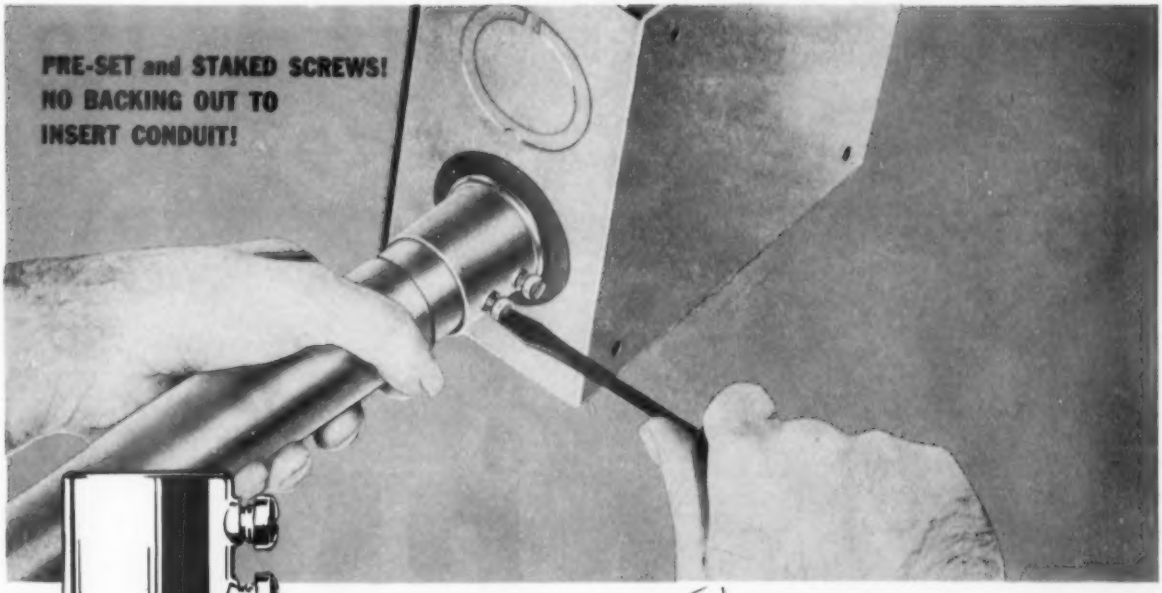
For complete information contact your nearest Clark sales office or Clark distributor, or write us direct.

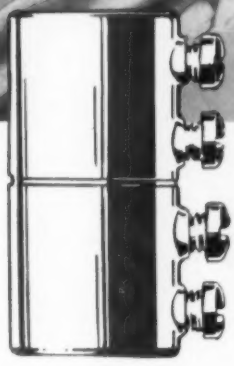
The CLARK CONTROLLER Company

Everything Under Control

1146 East 152nd Street • • Cleveland 10, Ohio

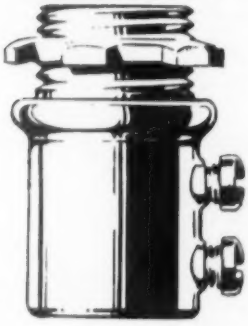
IN CANADA: CANADIAN CONTROLLERS, LIMITED • MAIN OFFICES AND PLANT, TORONTO





NEW 1¼"

Tube-weld SET SCREW COUPLINGS and CONNECTORS



- Pre-Set and Staked screws!
- No costly, time-consuming backing out when inserting conduit!
- Concrete-Tight approved!
- Precision-made, one piece, solid steel tube — heavily plated and resized for uniformity!
- Far surpasses UL requirements.
- Tube-weld fittings NOW available in ½", ¾" and NEW 1¼" sizes.

WRITE FOR FREE BROCHURE

Electric Tube Products
74-16 Grand Avenue
Maspeth, (N.Y.C.) N. Y.

ECM 3-57

Please send free brochure on ETP fittings. ☐
Please have representative call. ☐

Name ..... Title .....
Company .....
Address .....
City ..... State .....

ELECTRIC TUBE PRODUCTS
A Division of Berger Machine Products
74-16 Grand Avenue, Maspeth (N.Y.C.), N.Y. · DEfender 5-8000

CONNECT WITH ETP FOR ECONOMY

Specify Red "D" Portable Cord

with "built-in"...

PM

Diamond **Type MD**® heavy, medium and light duty flexible cordage . . . rubber insulated with rubber or neoprene jacket.

Maximum flexibility, moisture resistant. Conveniently marked-to-measure!

Diamond DTX® Non-Metallic WHITE Sheathed Cable. Non-sticking, smooth and easy to pull. Clean to handle, does not flake off!

PREVENTIVE MAINTENANCE gets top priority from industrial management . . . so when the job calls for an industrial application of Portable Cord, specify the product with "built-in" PM! Diamond Portable Cord and Red-D-Prene® assure the industrial user maximum protection against costly downtime caused by cord failures. The tough, oil and abrasion resistant sheaths give long wear, reduce maintenance costs. Red-D-Prene, first portable cord produced in Industrial Red, is readily identified . . . thus minimizing accidents.

Trade Mark ®

DIAMOND

WIRE and **CABLE** Company

Sycamore, Illinois

Specify AMERICAN PLASTIC LOUVERS—

latest...lightest...strongest...finest lighting medium

For any installation you may be planning — individual fixtures, troffers, modular designs or over-all ceilings — specify AMERICAN Plastic Louvers.

They're easy to work with — can be easily *sawed* to fit anywhere, even around pillars and obstructions.

They're scientifically designed to provide the maximum amount of light, at minimum brightness, without trapping light. Cells are perfect cubes of 5/8"; light cut-off is 45° x 45°.

They're de-staticized; dirt and dust fall through. They're easy to clean, tough and damage-resistant.

Strong, lightweight louvers do away with need for costly, heavy ceiling construction.

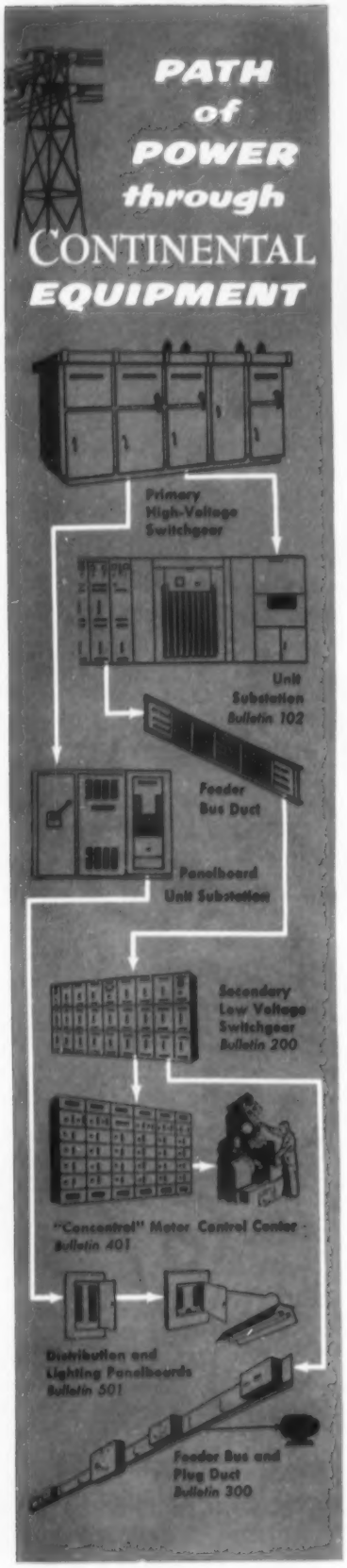
And — most important of all — there's practically no maintenance cost, to keep the utmost in appearance while insuring low cost to the consumer.

Exclusive process by American Louver Company
U.S.A. Patent No. 2,566,817 U.S.A. Patent No. 2,607,455
Canadian No. 484,346 Canadian No. 497,047

For further information about the most modern and versatile louvers available, write to:

AMERICAN LOUVER COMPANY

4240 NORTH SAYRE • CHICAGO 34, ILLINOIS



CONCENTRATE MOTOR CONTROLS IN ONE COMPACT "PACKAGE"

"Concentrol"

MOTOR CONTROL CENTERS

"Concentrol", achievement of CONTINENTAL design, engineering and craftsmanship, assures you of maximum personnel safety and production continuity in a motor control center. Self-supporting, pre-wired and standardized, it cuts installation time and costs, saves hours of engineering.

- ***MODULAR CONSTRUCTION*** — structures can be added or moved quickly, easily.
- ***SPACE SAVING*** — back-to-back arrangement requires half the floor space.
- ***EASY ACCESSIBILITY*** to all units, for reduced maintenance.
- ***ALUMINUM*** construction available.
- ***USES STANDARD STARTERS*** of your own choice.

Compare for yourself.
Write for Bulletin 401 today.

SHIPMENT: 4 Weeks*

NEW "Concentrol" PLUG-IN UNITS

. . . for greater safety, easier insertion and removal. All wiring is accessible from front. Removable door hinges facilitate installation and maintenance.

CONTINENTAL ELECTRIC EQUIPMENT CO.

General Offices: 204 West 4th Street, Cincinnati 2, Ohio

Manufacturing Plants in Ludlow, Ky. and Tampa, Fla. Sales Engineering Offices in all Principal Cities

*Standard arrangements with size 1, 2 and 3 full voltage, non-reversing starters. For other arrangements or starter requirements, refer to Factory.

Two Premium 75°C. Power Cables...and Both Cut

JOB COSTS

ROEBLING ROEPRENE TYPE RHW, STYLE RR, 75° C. POWER CABLE drastically slashes job costs when overloaded circuits in wet locations must be rewired. With RHW cable, you can increase current carrying capacity 18% to 50%, depending on ambient temperature, without increasing conductor size. This means there's no need to rip out and install new conduits to accommodate larger cable. Important savings in time, money and inconvenience are realized.

This versatile 600 volt cable*, suitable for operation at 75° C. in both wet and dry locations, is designed for service in underground ducts or above ground in conduits. Its insulation is specially compounded for superior aging and moisture resistant characteristics. The Roeprene sheath resists acids, most oils, moisture, flame and abrasion.

ROEBLING ROEPRENE TYPE USE, STYLE RR, 75° C. CABLE, with its new, higher temperature rating for wet locations, transmits more current through smaller size cable, thereby reducing installation costs.

Made for 600 volt service, it can be used in both wet and dry locations at 75° C. Roebling RHW insulation resists heat and moisture. Since the tough Roeprene outer sheath effectively withstands detrimental soil conditions, this cable is ideal for direct burial installations. As such, it provides a simple and direct connection from service pole to meter.

Both Roebling Type RHW and Type USE 75° C. power cables are available in single and multiple conductor construction, sizes 12 AWG to 2000 MCM. Size 14 AWG may be obtained for special applications. Write for full data, and order these cables from your distributor.

ROEBLING ELECTRICAL WIRES AND CABLES ARE AVAILABLE WITH EITHER COPPER OR ALUMINUM CONDUCTORS

*Also available as a building wire with cotton braid over RHW insulation.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

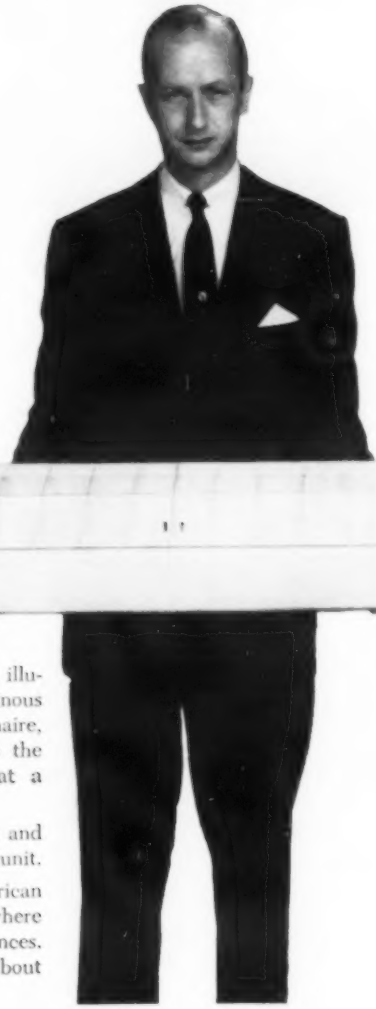
JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 2340 GLENDALE-MILFORD RD., EVENDALE • CLEVELAND, 13325 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, 1723 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

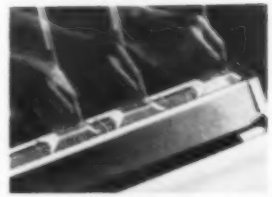
The beautiful **CAVALIER** *by Wakefield*

the luminaire de luxe

with the wonderful

sliding stem plate





The Wonderful Sliding Stem Plate

completely eliminates problems of in-line spacing of mounting points. It can be moved along the channel at will, to support the luminaire at any point. An additional convenience feature is the Wakefield adjustable ceiling strap which provides up to 1" adjustment of out-of-line or in-line error in location of mounting points.

Here are beauty, installing convenience and quality illumination wrapped up in one package. Unframed luminous plastic side panels run the full length of the luminaire, supported internally by a steel frame which is also the internal reflector, keeping side panel brightness at a pleasing 100 footlamberts.

A special Wakefield finish on louvers, side reflectors and channels gives uniform low brightness over the entire unit.

The Cavalier meets all requirements of the American Standard Practice for School Lighting in classrooms where care has been taken to use prescribed room reflectances. Shielding is 45° x 45° and the light distribution is about half up, half down.

Write for our Cavalier Catalog

THE WAKEFIELD COMPANY
VERMILION, OHIO

WAKEFIELD LIGHTING LIMITED
LONDON, ONTARIO

SOLA

L. C. MARSCHALL
EXECUTIVE VICE PRESIDENT

SOLA ELECTRIC CO.
4633 West 16th Street · Chicago 50, Illinois · Telephone Bishop 2-1414 · Cable Address "Solec"

FLUORESCENT LIGHTING SPECIFIERS AND USERS:

THE NON-CERTIFIED FLUORESCENT BALLAST THAT SELLS FOR A FEW NICKELS LESS THAN A CERTIFIED BALLAST ACTUALLY COSTS THE USER MANY DOLLARS MORE

The fluorescent lighting ballasts you buy today may carry one or both of two emblems. One is a circular emblem carrying the letters UL. It appears on virtually all ballasts and signifies only that the ballast meets safety requirements specified by Underwriters' Laboratories.

Increasingly you will see another emblem, diamond shaped, with the words "CBM CERTIFIED by ETL." This emblem identifies the ballast as one which meets rigid performance specifications set forth by Certified Ballast Manufacturers to assure optimum lamp and ballast operation.

Many manufacturers are now making ballasts which carry only the UL emblem. These ballasts are often referred to as "UL Ballasts" or erroneously, as "UL-approved" ballasts.

In order to save a few nickels per ballast, many people are buying these non-certified ballasts, apparently under the impression that UL listing signifies approval of design and construction characteristics upon which satisfactory lighting performance depends. It does not.

The truth is that Underwriters Laboratories do perform a valuable, but highly specialized function in testing ballasts. UL listing indicates only that safety requirements are met. UL does not test for any operating characteristics that assure efficient, economical performance and long lamp life.

How, then, can you be sure that a ballast will meet the quality standards necessary to insure efficient performance? The answer is simple: buy ballasts that are certified to meet CBM specifications wherever such specifications exist.

Without CBM specifications there are no standards for lumen output, lamp life, peak to RMS ratio (wave shape), starting voltage...

no floor under quality. CBM certification assures the user that a ballast will meet or exceed accepted minimum standards on all these factors.

The actual COST of non-certified ballasts? We invite you to GET THE FACTS. We have prepared an engineering report, carefully and accurately calculated from figures published by a leading company who makes non-certified ballasts. Their own figures show that the lamp life of non-certified ballasted lamps is reduced as much as 28%; light output by as much as 13%, compared with certified CBM ballasts used in the same installations.

Calculated in operating costs, our report shows that while the initial cost of non-certified ballasts may be pennies less, their actual cost is many dollars more in terms of reduced lumen output and long lamp life alone.

The Sola Electric Co. has no "double standard" of quality for lighting ballasts. In addition to being UL listed, EVERY Sola ballast for general lighting applications meets or exceeds CBM specifications - and is so certified - in every case where CBM specifications or proposed specifications exist. You are assured optimum lamp performance and efficient, economical ballast operation with every Sola ballast you buy.

GET THE FACTS...write today for Sola's engineering report on the real cost of non-certified fluorescent lighting ballasts.

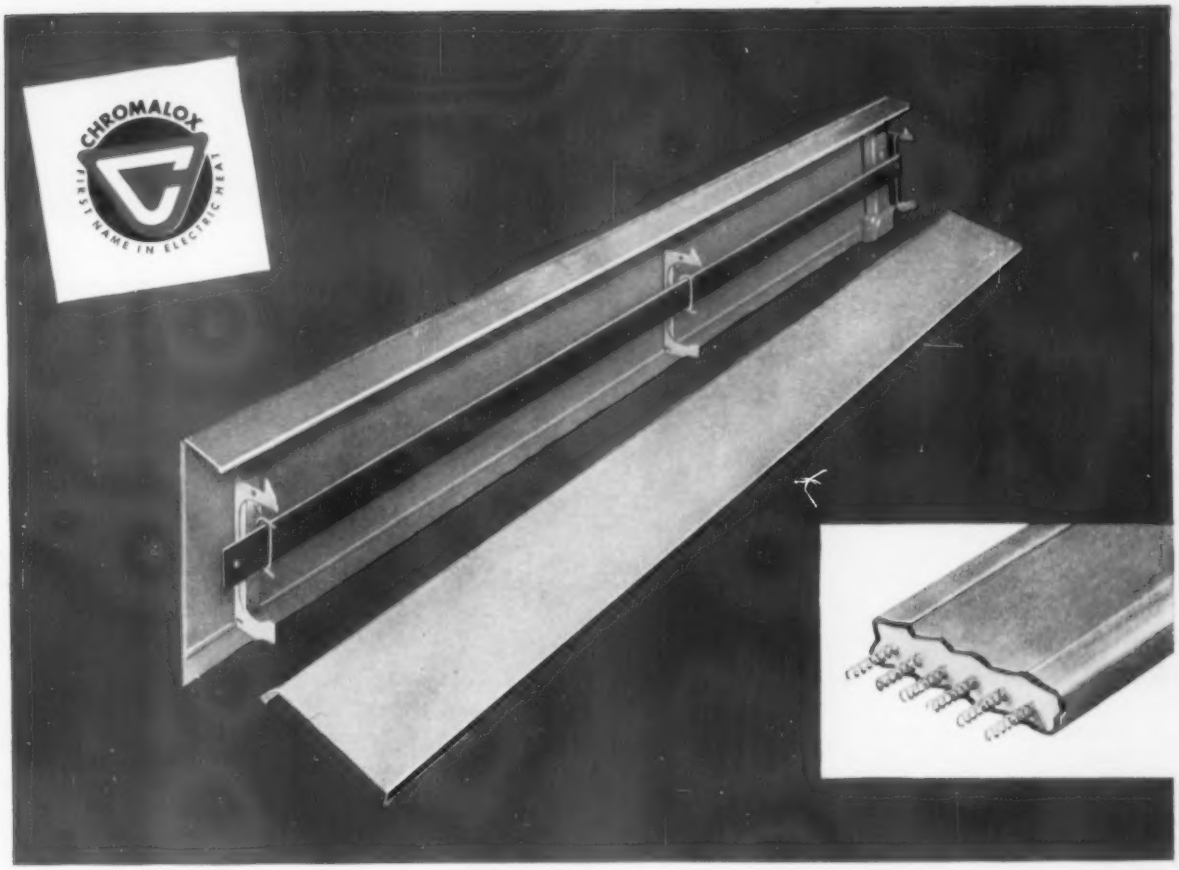
Sincerely yours,

SOLA ELECTRIC CO.

L. C. Marschall
Executive Vice President

LCM:vm

P.S. Would you like other members in your organization to have a copy of Sola's engineering report on the real cost of non-certified ballasts? Please indicate the number of copies you require. We will be happy to mail them to you.



better electrical components

help make **CHROMALOX** Electric Baseboards the Quality Line

Top quality electrical components combined with smartly styled appearance are making Chromalox baseboards the standout line. The built-in quality of the electrical equipment is the result of forty years' experience in designing and building electric heating equipment—exclusively. Consider for a moment the important advantages in quality electrical components.

The heat source is a metal sheath strip heater, fully insulated for safety, and sheathed in metal for strength. It is completely shock-, break-, and moisture-proof. Its smooth finless surface cannot sag on over-voltage, and won't char dust, dirt and lint. No seasonal maintenance is required. Proved in more than 40 years of tough industrial use, it now goes to work bringing years of trouble-free performance to the American Home.

Wiring is simplicity itself. The versatile splice box can be wired from the bottom, back, or either side. Two adjacent connections are all that is necessary to connect 16 feet of baseboard heat. And Chromalox baseboards are designed to tie-in with standard surface raceway, can be connected with ordinary T wire.

Chromalox Electric Baseboard is available in four practical lengths, at 120, 208 and 240 volts. Single and two heat stages are supplied for modulated output. And there's a new "high wattage" series delivering 300 watts per lineal foot for unusual installations. It's protected with a UL listed thermal cutout.

Chromalox quality tops the field. It's backed by a no-time limit guarantee on workmanship and materials. You can get the full story simply by writing for a copy of Bulletin 800-A.

B-634

Edwin L. Wiegand Company

RESIDENTIAL HEATING DEPARTMENT

7637 Thomas Boulevard, Pittsburgh 8, Pennsylvania

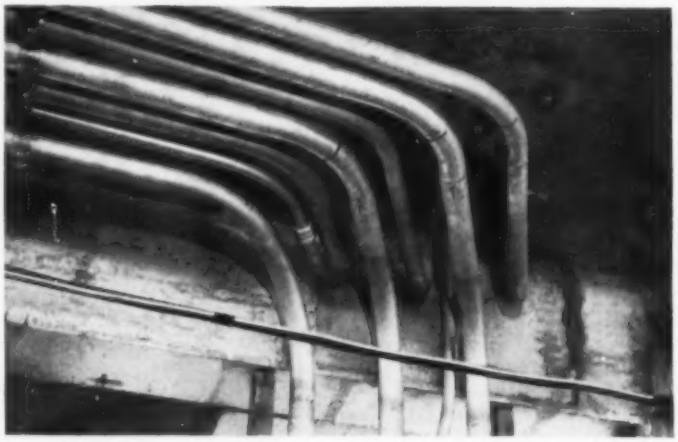
Heat Better . . . Electrically

The Best Costs Less Installed

makes all sizes of

West Islip High School, Suffolk County, N. Y.
Architects-Engineers: Frederic P. Wiedersum, Valley Stream, N. Y.
Electrical Contractor: ABC Electrical Contractors, N.Y.C.

EASY-TO-INSTALL Republic ELECTRUNITE E.M.T. provides for future wiring requirements. The exclusive knurled "ball-bearing" inside surface makes wire pulling and "fishing" up to 30% easier. Changing conductors at any time is a cinch.



LARGE DIAMETER Republic ELECTRUNITE E.M.T. is easily bent with a Republic Hydraulic Bender. Note the smooth, uniform bends in this 2" raceway. And there's never any flaking, peeling or chipping either. For uniform characteristics regardless of size, plus helpful features to make installation easier, there is no finer raceway than Republic ELECTRUNITE E.M.T.

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

UNIFORM DUCTILITY

Republic ELECTRUNITE E.M.T. easy to install

Smooth-bending feature simplifies big Long Island school installation

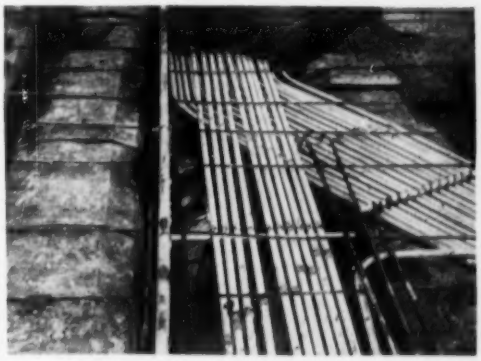
A lot of Republic ELECTRUNITE® E.M.T. was installed in the new West Islip High School, largest in Suffolk County, New York. And regardless of size—¾″, 1″ or 2″—electricians found the bending characteristics the same. Smooth, uniform bends were made quickly and easily, with no costly kinks—thanks to the *uniform ductility* in every foot. And in the larger sizes—like 2″—it eliminated the need for elbows and extra fittings, a substantial savings in labor and materials.

Uniform ductility is just one of the important advantages you get in Republic ELECTRUNITE E.M.T. Another is the tight-adhering galvanized coating that will not chip, flake or peel even when the tube is severely bent.

Republic ELECTRUNITE E.M.T.'s exclusive features help simplify the job from planning to wire pulling. The "INCH-MARKED" feature speeds accurate cutting and bending. Every inch of the raceway is marked in feet and inches for quick measurement.

The handy "GUIDE-LINE", which extends the full length of the raceway, simplifies the bending operation. By aligning with the arrows on the Republic Calibrated Bender, it's easy to make bends in the correct plane—avoid costly "wows". Both features come on all popular sizes. And wire pulling is easier because of the knurled inside surface of the raceway.

You'll like to work with Republic ELECTRUNITE E.M.T. There are no threads to cut, no lines to turn. To make joints tight, you turn the nut, not the entire run. Try Republic ELECTRUNITE on your next job. Be sure to ask your electrical distributor for the E.M.T. that's "INCH-MARKED" and "GUIDE-LINED". Mail coupon for literature giving complete specifications.



EXCELLENT FOR CONCRETE, Republic ELECTRUNITE E.M.T. is 100% approved by the National Electrical Code for concealed, exposed, and concrete slab installations. It provides effective grounded protection for all electrical circuits, call systems, and telephone leads, from moisture, fire and mechanical injury. Millions of feet have been installed successfully in every conceivable type of concrete installation.

ACCURATE STUBS, smooth back-to-back and saddle bends are easy to make with a Republic Bender, using the helpful "INCH-MARKED"® and "GUIDE-LINED" features. To cut Republic ELECTRUNITE E.M.T., an ordinary 32-tooth hack saw will do the trick. Why not specify Republic on your next job and save on installation costs? Remember, the *best* costs *less* installed.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
Steel and Tubes Division
212 East 131st Street
Cleveland 8, Ohio

Gentlemen:
Please send me additional information on Republic ELECTRUNITE "INCH-MARKED" E.M.T.

Name_____ Title_____

Company_____

Address_____

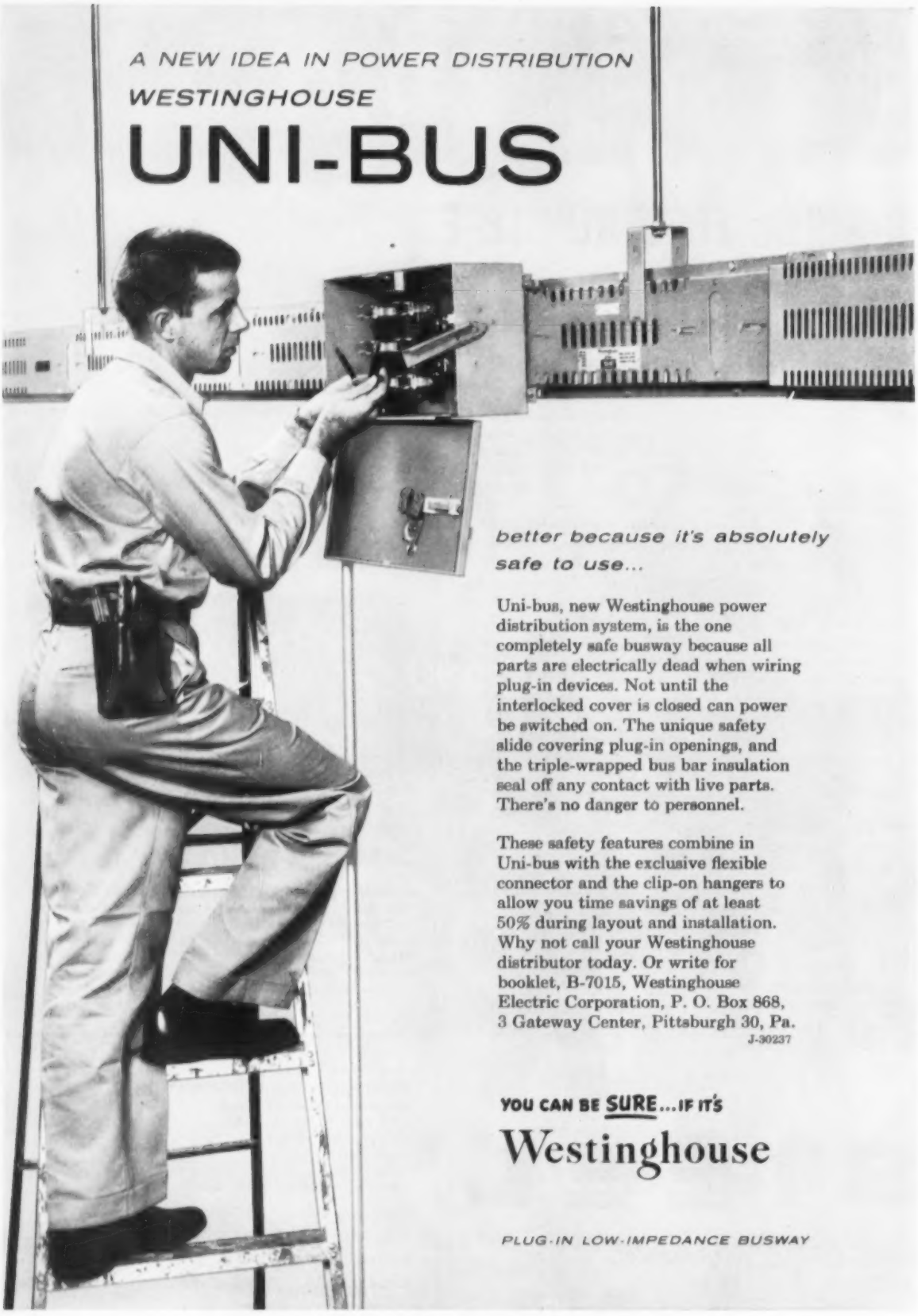
City_____ Zone____ State_____

C-3224

A NEW IDEA IN POWER DISTRIBUTION

WESTINGHOUSE

UNI-BUS



better because it's absolutely safe to use...

Uni-bus, new Westinghouse power distribution system, is the one completely safe busway because all parts are electrically dead when wiring plug-in devices. Not until the interlocked cover is closed can power be switched on. The unique safety slide covering plug-in openings, and the triple-wrapped bus bar insulation seal off any contact with live parts. There's no danger to personnel.

These safety features combine in Uni-bus with the exclusive flexible connector and the clip-on hangers to allow you time savings of at least 50% during layout and installation. Why not call your Westinghouse distributor today. Or write for booklet, B-7015, Westinghouse Electric Corporation, P. O. Box 868, 3 Gateway Center, Pittsburgh 30, Pa.

J-30237

YOU CAN BE **SURE**...IF IT'S

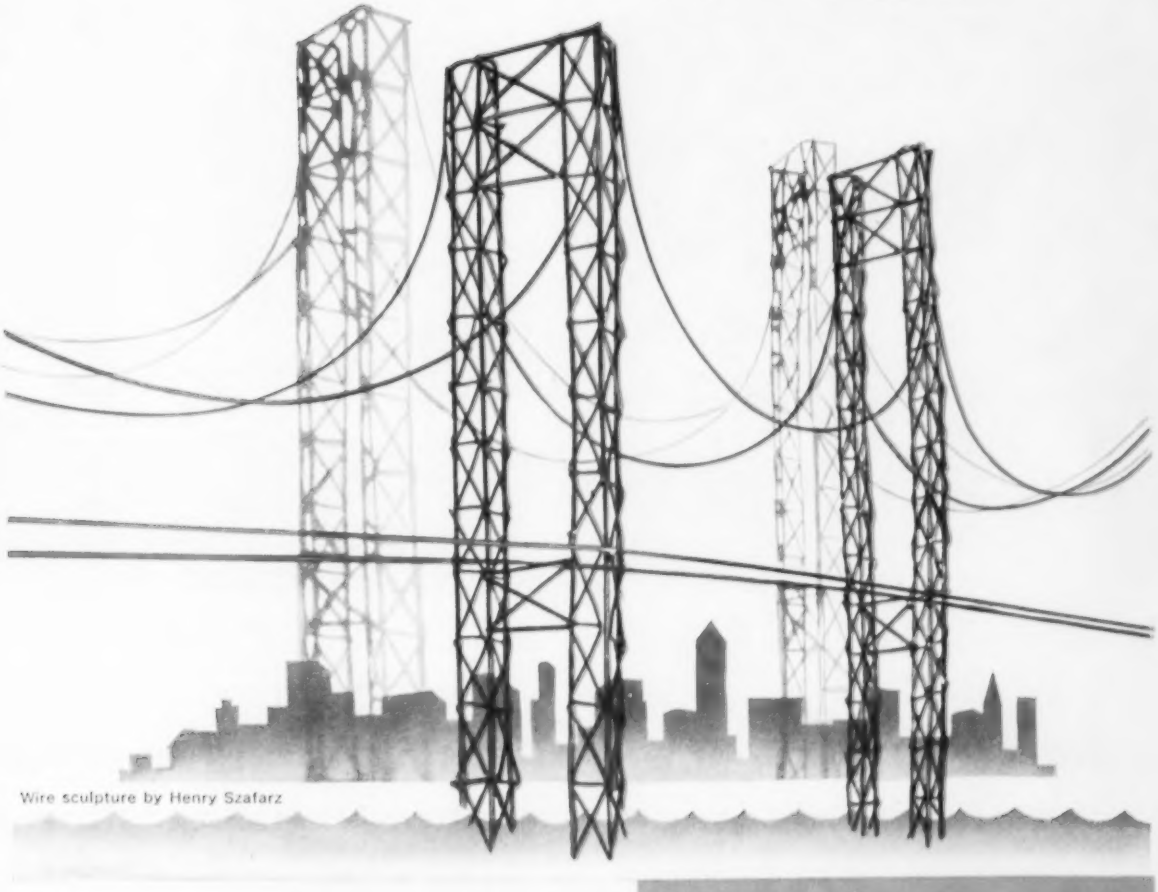
Westinghouse

PLUG-IN LOW-IMPEDANCE BUSWAY

"Monument to Power"

Every engineered structure stands as a tribute to the men who planned and built it. And to the efficiency of their equipment, too.
Simplex-ANHYDREX cables, for instance, which are used everywhere for power distribution, control, floodlighting and numerous other functions. These expertly-engineered cables are equally suitable for overhead or in-the-ground use. They resist sunlight, ground acids, alkalies, oil, heat and flame, and their ANHYDREX insulation makes them super-resistant to water.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Mass.

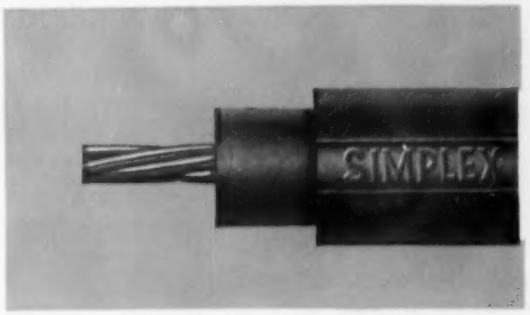


Wire sculpture by Henry Szafarz

Simplex

LOVE BETTER ELECTRICALS

ANHYDREX



Newest resort hotel at Fort Lauderdale Beach, Florida, is the Yankee Clipper. This modern structure includes 122 guest rooms, six apartments. SPANG Conduit protects all wiring throughout.

"Spang Conduit's excellent handling qualities made it first choice for the Yankee Clipper

—says Mr. Verne Franke, President, Atlantic Electric Incorporated

Fort Lauderdale Beach's newest hotel, The Yankee Clipper, containing 122 luxurious rooms and six apartments, opened in the summer of 1956.

SPANG HD Galvanized Conduit and SPANGLEAM EMT were chosen to protect the wiring through the hotel, reports Mr. Franke, "because of our past experience with their excellent handling qualities and durability in this seacoast town—plus the fine service we have received from SPANG and its local distributor."

ON-THE-JOB REPORT . . . Mr. Monroe Sarvis, project electrician, says this about the Yankee Clipper installation: "SPANG HD Conduit was uniformly easy to bend, cut and thread. I never had to worry about burrs or other inside faults. The hot-dipped galvanized finish never flaked off.

"SPANGLEAM EMT was installed on short runs. We found it was not only easy to bend, but the slick inside finish cut our installation time way down, thereby facilitating a swift and clean job."

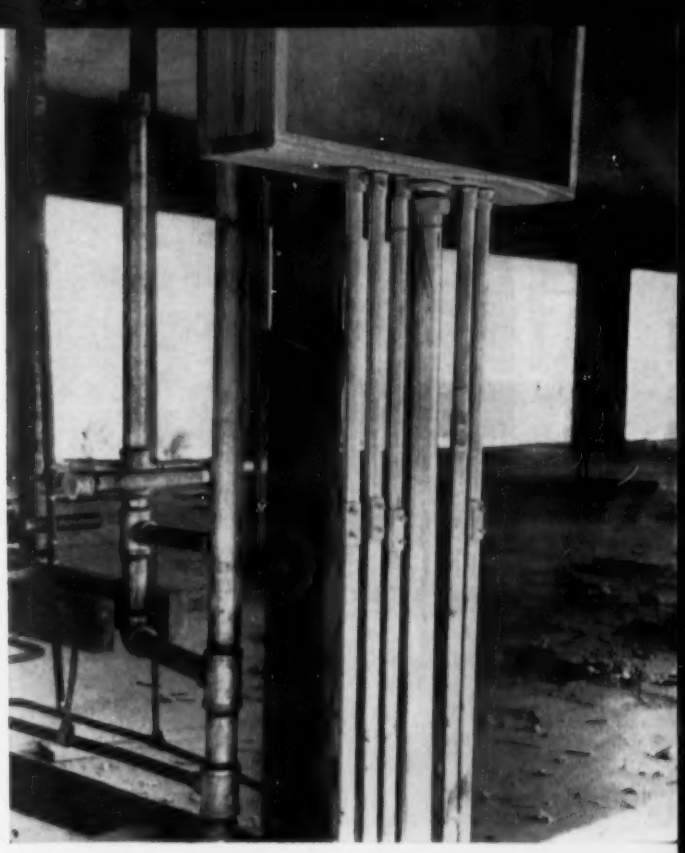
Owner and General Contractor—Gill Construction Company, Fort Lauderdale
Architect and Engineers—M. Tony Sherman, Miami
Electrical Contractor—Atlantic Electric Inc., Fort Lauderdale
SPANG Distributor—Service Electric Supply Company, Fort Lauderdale

and durability installation"

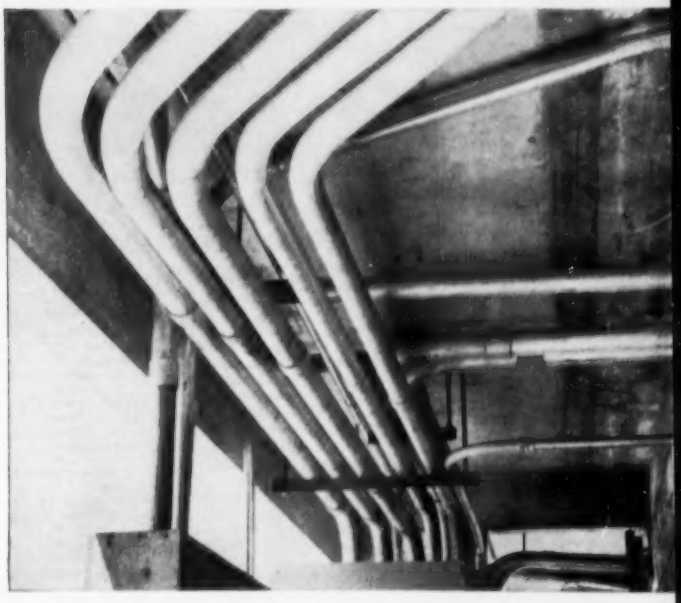
Fort Lauderdale, Florida

LET SPANG HELP YOU . . . You can always count on a *top-quality* installation with *quality-controlled* SPANG HD Conduit and SPANGLEAM EMT . . . because SPANG carefully controls each step in the manufacturing of its conduit, and carefully tests and inspects each lot before shipping to be sure you get a *top-quality* product every time.

Try SPANG on your next job. And you can count on your nearby SPANG Distributor for *top-quality* service, too!



SPANGLEAM EMT was used on light load-bearing lines. Slick interior finish on SPANGLEAM speeded up job-finishing time.



From past experience, Atlantic Electric Inc., contractors on the job, know that SPANG Conduit provides excellent corrosion resistance from salt air. Electric crews report SPANG HD easy to cut, bend and thread.

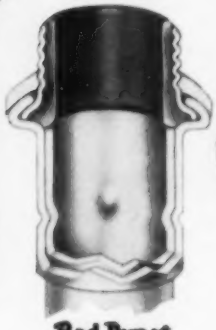
SPANG® CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
TWO GATEWAY CENTER, PITTSBURGH, PA.
District Offices and Sales Representatives in Principal Cities

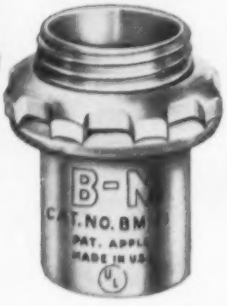
B-M

the original concrete-tight **INDENTER FITTINGS** *for E.M.T.*

Red Throat
Insulated Connector



Red Throat
Cross section



"BM" #100
Cutter for ½, ¾ and 1" E.M.T.

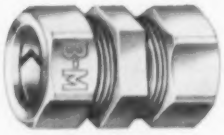
"BM" #1000
Holder for ½, ¾ and 1" E.M.T.

"BM" #607
½" Indenter

"BM" #600
Changeable Jaw Indenter

Briegel Rain-Tight E.M.T. Compression Fittings

SIZES FROM
½" to 2"



SIZES FROM
½" to 2"

SIZES
½", ¾", 1"

SIZES
½", ¾", 1", 1¼"

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All B-M Indenter Fittings are U.L. Approved as concrete-tight and all Compression Fittings as rain-tight as well as for general use (File Card E10863). Also comply With Federal Specifications W-F-406.

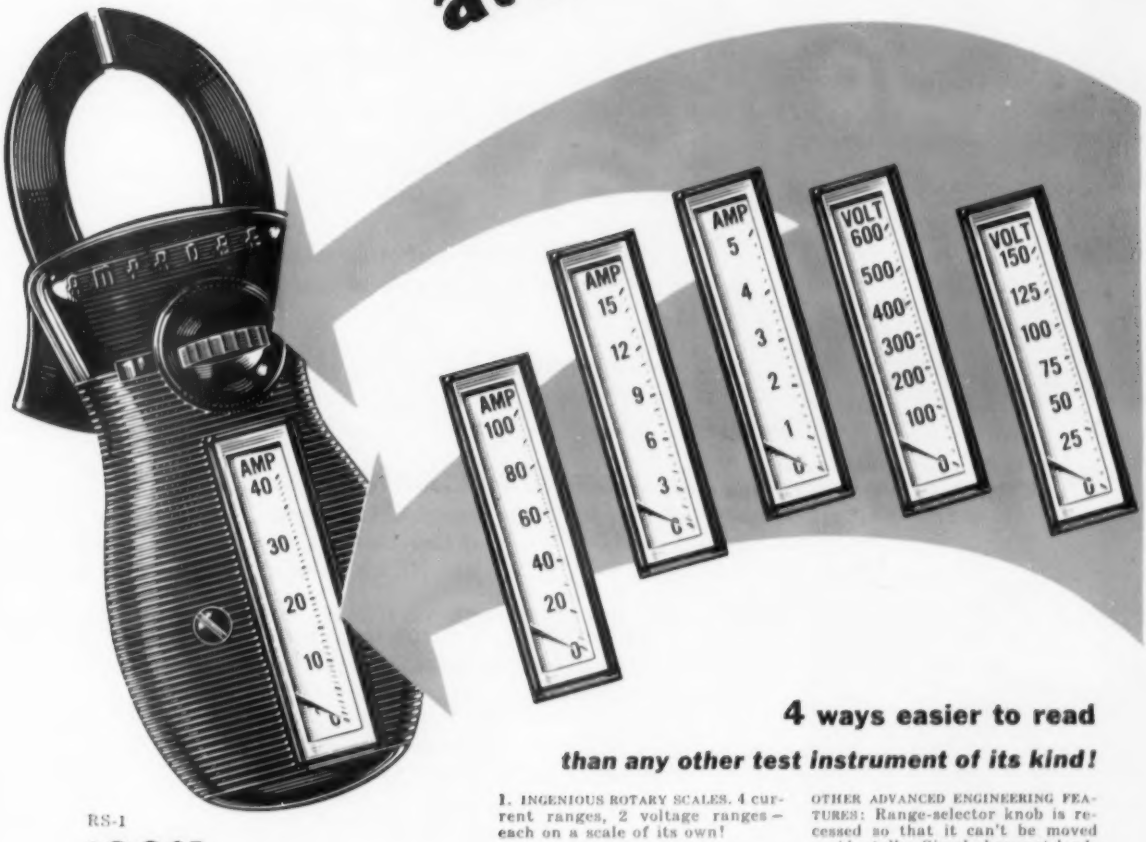
BRIEGEL METHOD TOOL CO.

GALVA, • ILLINOIS

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

NEW ADVANCED DESIGN ROTARY RANGE AMPROBE RS-1

see only one scale at a time!



RS-1

$39.85

There's one for every job and every budget.

The new RS-1 is one of the 14 AMPROBE models priced from $19.85 to $67.50.

4 ways easier to read

than any other test instrument of its kind!

1. INGENIOUS ROTARY SCALES. 4 current ranges, 2 voltage ranges — each on a scale of its own!

2. ONE HAND OPERATION! Range selector knob is next to your thumb.

3. NEW MAGNIFIED DIAL . . . LONGER SCALE LENGTH. Greater visibility, greater accuracy, than ever before.

4. POINTER-LOCK "FREEZES" POINTER AT READING. Use the RS-1 any place your hand can reach. Needle can be locked in place so that you may read it away from conductor.

OTHER ADVANCED ENGINEERING FEATURES: Range-selector knob is recessed so that it can't be moved accidentally. Simple bayonet leads lock in at bottom for quick connecting. Impact-proof case with non-slip ribbing. Advance printed circuit construction. Shielded core magnetic movement. Leather carrying case can be worn on your belt.

Amprobe, a division of Pyramid Instrument Corp., Lynbrook, New York, manufacturers of famous REMCON simplified low-voltage Hi-Fashion switching devices.

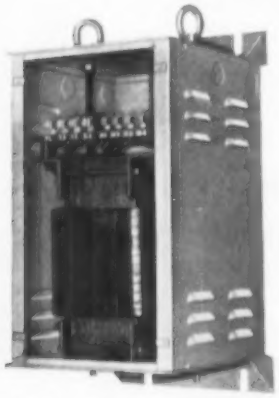
* Ⓡ

don't guess at it; AMPROBE IT!

SORGEL dry-type transformers are *really different!*

They are not just ordinary transformers

15 to 50 Kva 3-phase. Wall mounting. Connection compartment panel removed



20 to 75 Kva single phase. Wall mounting. Connection compartment panel removed

Compare and check these features:

QUIET OPERATION — The sound level of SORGEL dry-type transformers is well below the established standards. Adaptable for any indoor installations, especially where sound level is an important factor.

LIBERAL DESIGN — High efficiency at all loads, with a liberal overload capacity at a safe operating temperature.

EASY INSTALLATION — Wall brackets or floor mounting bases are an integral part of SORGEL dry-type transformers. Solderless terminals.

UNDERWRITERS' APPROVED in all the ratings covered by the Re-examination Service, both single phase and 3-phase. They also meet or exceed the requirements of ASA, AIEE, and NEMA standards.

LONG LIFE — Vacuum impregnated windings brazed to solderless terminals assure years of trouble-free service.

Available in all standard and intermediate ratings and voltages — ¼ to 3000 Kva up to 15000 volts.

Also Special Transformers and D.C. Saturable Reactors

SUBSTATIONS — SORGEL transformers, either dry-type or Askarel-cooled, are incorporated in substations, complete with primary or secondary switchgear. They are procurable with any make or type of switchgear, and from any substation manufacturer.

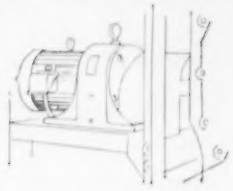
SORGEL TRANSFORMERS

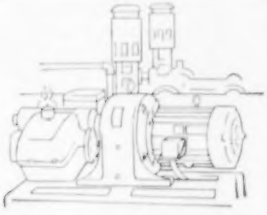
SORGEL ELECTRIC CO. 836 WEST NATIONAL AVE., MILWAUKEE 4, WIS.

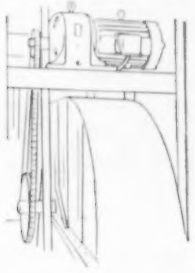
Sales Engineers in Principal Cities

SLOW SPEEDS...TOP EFFICIENCY!

new completely redesigned Century-powered GEARMOTORS



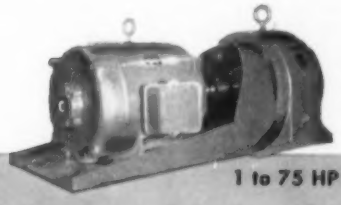




Totally Enclosed
Fan Cooled Design shown

Single, double and triple reduction available with output speeds from 750 to 7.5 RPM. 1 to 125 HP.

the right combination of quality motor and quality gearing for trouble-free service:



1 to 75 HP

Ideal where quick motor interchangeability is necessary. Double and triple reduction units with output speeds from 350 RPM to 7.5 RPM.

- **Performance-Rated© polyphase, single phase and DC Motors**
- **Duti-Rated Lifetime High-Capacity Gearing**

Newest improvements in gearmotor design—assure you top efficiency in all your slow-speed power applications! Century Gearmotors combine famous Century motor quality and precision gearing to give you increased dependability, cooler operation, maximum wear life . . . trouble-free service even under your heaviest loads! Variety of mounting positions available including downshaft and tilted shaft.

Performance-Rated to your specific needs . . . available in open drip proof, dust proof, explosion proof and totally enclosed frames. Call or write your nearby Century District Sales Office or Authorized Distributor.

Performance-Rated© MOTORS
1/20 to 400 HP

CENTURY ELECTRIC COMPANY

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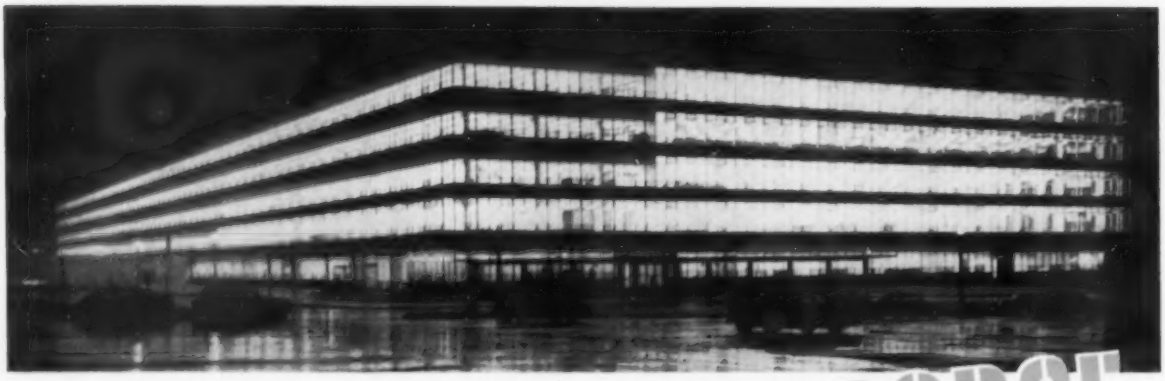
1806 Pine Street • St. Louis 3, Missouri • *Offices and Stock Points In Principal Cities*

New Home for Army Service Records



WIRE BY PHELPS DODGE

This modern AG Record Center building* in St. Louis, Mo., is virtually an oversized glass filing cabinet. Housed here are service records of 20,000,000 persons who have served in the Army or Air Force since the Civil War.

A dependable wiring system was an important part of the building's specifications. That's why Phelps Dodge wire and cable was installed.

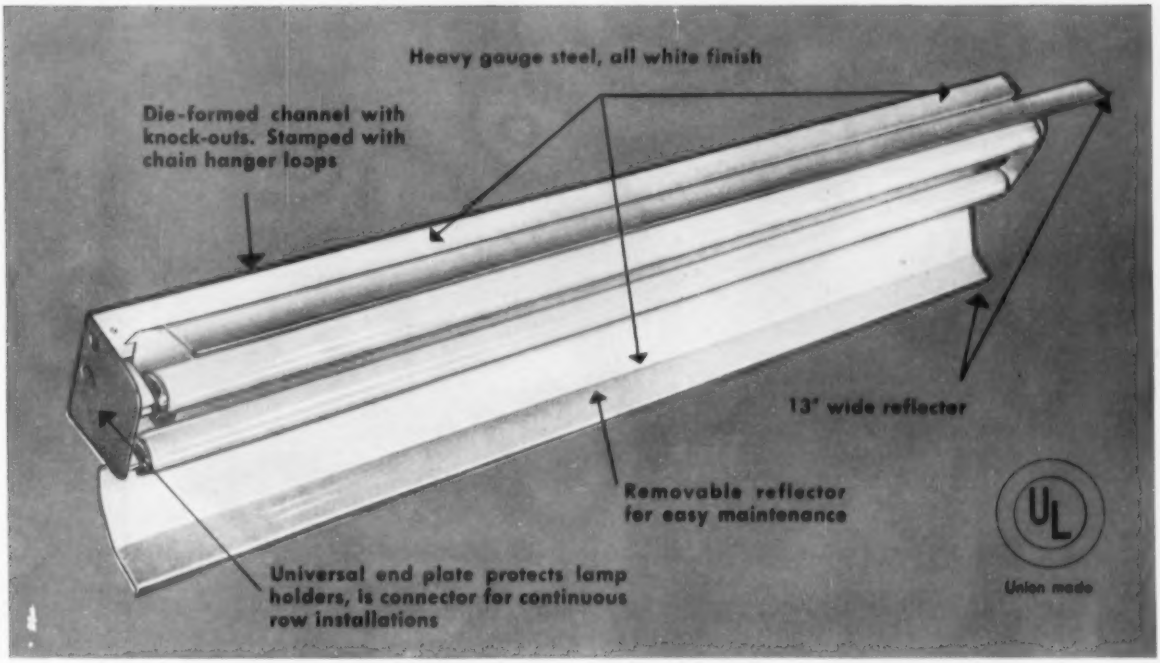
On every wiring job, where top-quality materials, expert workmanship and experienced "know-how" are called for, *it pays to rely on Phelps Dodge and your Phelps Dodge distributor!*

*Joint General Contractors: Fruin-Colnon Contracting Co., St. Louis, Mo., and Peter Kiewit Sons' Co., Omaha, Neb., Electrical Contractor: Mack Electric Co., St. Louis, Mo.

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

Virden Value Specials


Heavy gauge steel, all white finish
Die-formed channel with knock-outs. Stamped with chain hanger loops
13" wide reflector
Removable reflector for easy maintenance
Universal end plate protects lamp holders, is connector for continuous row installations
UL
Union made

New Industrial Fixtures at Low, Low Prices.

Now you can quote and sell those competitive industrial lighting jobs. Here are industrial fixtures that offer excellent lighting efficiency yet are priced amazingly low. Made by Virden they are quality products, offering many features found only in higher priced units. Available in 48" fluorescent and 96" slimline, 2-lamp fixtures, designed for mounting singly or in continuous rows. They will prove excellent business getters. Ask your Virden distributor about them today. Or mail the coupon below to John C. Virden Co., 6103 Longfellow Ave., Cleveland 3, Ohio.

Available in the following types:

V-10224
2-lamp 40W HPF Pre-Heat 48" Fluorescent Industrial All White Baked Enamel Finish.

V-10225
Small as V-10224 only with All White Porcelain Reflector.

V-10226
2-lamp 40W Rapid Start 48" Fluorescent Industrial All White Baked Enamel Finish.

V-10227
Same as V-10226 only with All White Porcelain Reflector.

V-10328
2-lamp 75WT12 430 MA 96" Slimline Industrial All White Baked Enamel Finish.

V-10329
Same as V-10328 only with All White Porcelain Reflector.

E.T.L. Lead Lag and Cold Weather Ballasts available at slightly higher prices.

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LIGHTING

Mail this coupon for more details

John C. Virden Co., Dept. ECM-357, 6103 Longfellow Ave., Cleve. 3, O.
Send details on your Industrial Fixtures V-10000 Series.

Name _____

Address _____

City _____

State _____

GUTH-LIGHT guards

THE EYES OF TEXAS!

4,200 GUTH TROFFERS..... ALZAK ALUMINUM LOWEST LOW-BRIGHTNESS TROFFERS IN NEW U.S.A.A. BUILDING, SAN ANTONIO

Texans think big and demand the best! That's why designers chose Guth Troffers for the magnificent new home office of United Services Automobile Association, San Antonio.

Their distinctive, custom-made look adds beauty to the contemporary decor... the shadowless, low-brightness lighting (with at least 65 ft. candles throughout) assures eye-ease and efficiency. What a combination!

And more: Guth's complete-unit design made the installation double-easy. No on-the-job assembly... they're ready to hang.

WRITE FOR GUTH TROFFER CATALOG NO. 50-A

ARCHITECTS: Phelps & Dewees & Simmons-Atlee
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ELECTRICAL CONTRACTOR: Paul Wright Electrical Co., San Antonio
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THE EDWIN F. Guth COMPANY · ST. LOUIS 3, MO.

TRUSTED NAME IN LIGHTING SINCE 1902

ELECTRICAL CONSTRUCTION AND MAINTENANCE

56th Year — MARCH • 1957

Sales Aids Can Help

Booming business in residential electrical modernization, backed by unprecedented consumer educational and promotional programs, will reach new heights in the months ahead. Those electrical contractors who have actively sought this class of work have found it easy to sell. And jobs well sold often bring in over-the-transom orders from neighbors in a community chain reaction.

The customer presents few problems. He already knows his wiring is old and inadequate. He is quite aware that appliances like ranges, dryers and air conditioners take special wiring and that his service fuses are probably not big enough. He knows that he must ultimately call in an expert to fix the place up. The willing contractor who wants to ring doorbells can build business, much of which he is bound to sign up profitably for himself. But sometimes the going is rough.

Other contractors are not always willing to do as sincere a job of missionary work. But they will still contend for the business if they are called in by a home owner who wants another price. The resulting competition often leaves the initial salesman, who is trying to carry out the intent and spirit of industry promotions, with the major sales cost and the "high" price, while a competitor picks up the job.

There is nothing new about such tactics and they need not be discouraging to those contractors who want to do a full scale, top quality job. The situation calls for the effective use of industry sales aids. By nailing the job down in specific description, the earnest salesman can build customer confidence and write the full specifications that this competition, if any, must meet or beat. And a detailed written proposal summing up a plain price list can easily discourage further shopping.

The use of the "Housepower Rating Sheet", "Worksheets" like those in our January issue, the "Live Better Electrically" booklets, the "Residential Wiring Handbook" and other helps from the National Adequate Wiring Bureau are all effective, vital aids that go on "selling" after the salesman has gone. And the well-informed prospect is not easily unsettled by vague verbal proposals at a cheaper price.

Economical attack on the broad public need for home wiring modernization calls for sound selling at reasonable prices without unnecessary and wasteful shopping, and confident, speedy closing on jobs of good technical quality and workmanship. Generous use of industry sales aids and recommended planning procedures by electrical contractors can do a great deal toward achieving these objectives and opening up home electrical systems for carefree, modern electrical living, today and tomorrow.

Wm. T. Stuart

There's one best tool for every job and one best place to get it—from GRAYBAR

Getting the job done faster – and better – is the two-way advantage of using modern tools in electrical contracting. They earn you another dividend, too. *Reputation.* Customers regard an electrical contractor whose tool equipment is up to the minute as being a top man in his field.

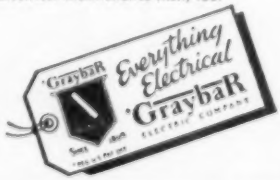
Always order your tools – hand tools as well as the power driven muscle savers – from Graybar. Because Graybar Suppliers are the outstanding manufacturers in this country, Graybar is the most authentic – and the most convenient – source of everything electrical. Whether your current problems take in large industrial projects, groups of modern homes, stores or individual house wiring, it will pay you to put the nearest Graybar Specialist on your team. Call Graybar today – for anything from a pair of eight inch side cutting pliers to a hydraulic pipe bender.

EVERY TOP-FLIGHT ELECTRICAL CONTRACTOR* in the U.S. and its possessions needs a copy of this comprehensive, well-illustrated catalog on the latest electrician's tools. Your copy is free. Just send us your name and address on your business letterhead.

79-43

*Plant Electrical Maintenance Men, too.

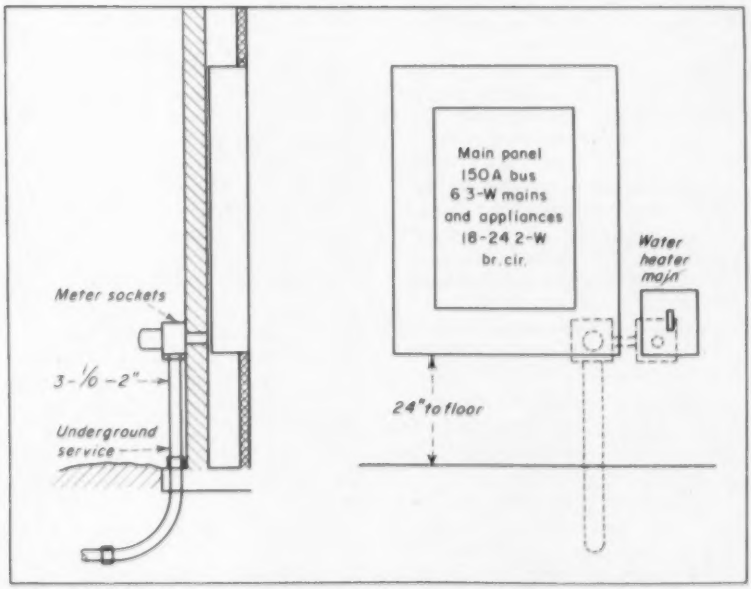
CALL GraybaR FIRST FOR



GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK, IN OVER 130 PRINCIPAL CITIES

High Capacity Wiring for Modern Electric Homes

Practical wiring plans of modern homes show influence of industry promotions in up-to-date layout and design practice for electric living today and tomorrow.



HIGH-CAPACITY service connections with underground service and branch circuit distribution in main panel installed flush in garage wall.

HOUSE wiring is big business—and getting bigger. The million or more new homes built each year represent almost a third of all construction—with electrical work running in the hundreds of millions of dollars. Every house has to be wired to some passable standard. But advancing utilization and a more critical public are compelling rapid progress in the useful capacity and utility of the modern house wiring system.

Powerful aids are helping in this progress. The National Adequate Wiring Bureau, and more recently the Live Better—Electrically and Housepower programs are bringing up-to-date information about electrical requirements to the public and to the many facets of the building industry. Concurrently, advanced planning methods for wiring for modern residential utilization by functional system design are available to guide the

TABLE 1

Typical load and circuit values for special purpose circuits

Appliance	Typical wattage	Circuit conductors	Voltage	Circuit protection	
Electric Range	10,800	#6	120/240	50-amp	
Oven—built-in	4,500	#10	240	30-amp	
Range top—2 Unit	3,000	#12	120/240	20-amp	
Range top—4 Unit	6,000	#10	120/240	30-amp	
Dishwasher	1,200	#12	120	20-amp	
Refrigerator-freezer	400	#12	120	20-amp	Note 1
Dryer	5,000	#10	120/240	30-amp	
Washer-dryer	5,000	#10	120/240	30-amp	
Washer	1,200	#12	120	20-amp	Note 2
Ironer	1,600	#12	120	20-amp	Note 2
Water heater	3,000	(as required by utility specifications)			
Air conditioner (room) ¾T	1,200	#12	120	20-amp	
Air conditioner (room) 1½T	2,400	#12	240	20-amp	
Central air conditioner	5,000	(as required by manufacturer's specifications)			Note 3
Heat pump	7,500	(as required by manufacturer's specifications)			Note 4
Heating plant	300	#12	120	20-amp	Note 5
Electric space heat	15,000	(as required by system layout)			Note 6
Bathroom heater	1,500	#12	120	20-amp	

The above loads are representative of those which require individual circuits, or which are preferably served by individual circuits as explained by the following notes:

Note 1. Refrigerators and freezers may be served by outlets on an appliance circuit. It is recommended, however, that these appliances be served by a separate circuit with no other outlets. The purpose of this recommendation is to eliminate the probability of interrupting the operation of these appliances as a result of connecting faulty cords or portable appliances to the same circuit.

Note 2. The automatic washer or the iron may be served by an outlet on an appliance circuit. Separate circuits are recommended, however, because at portions of the operating cycle such equipment often takes 50% or more of the full circuit capacity.

Note 3. Central air conditioning load and circuit requirements vary with the size and capacity of the plant. Typical residential plants are rated at 3 and 5 hp in compressor load and ½ hp in fan load. Wiring should be installed in accordance with the manufacturer's specifications.

Note 4. Heat pump load and circuit requirements vary with the size and capacity of the plant. Typical residential plants are rated at 3, 5 and 7½ hp in compressor load, ½ hp in fan load plus, in some instances, supplementary resistance heating. Wiring should be installed in accordance with the manufacturer's specifications.

Note 5. Many local ordinances require a separate circuit for the oil burner or heating plant. It is also advisable for the reasons given in Note 1 above.

Note 6. Electric heating load and circuit requirements vary with the heating design requirements. Fixed electric space heaters are conventionally connected on 240-volt, No. 12 or No. 10 branch circuits. The connected load should not exceed 80% of circuit capacity.

architect, engineer, and electrical contractor.

Emerging is the high-capacity wiring system. It has capacity to spare for present utilization and future load growth. It serves full power to fixed appliances. It provides ample power and convenience for any probable connection of portable appliances. It is fully and safely under control. It is readily and economically adaptable to future load requirements and equipment connections.

On current plans and specifications, the most apparent marks of modern high-capacity layouts are:

- Increased use of built-in major appliances and cooking units.
- Increased use of fixed lighting including recessed and valance equipments.
- Increased use of wall switch control and, particularly, multipoint switching and master switching.
- Increased use of outdoor lighting and receptacle outlets.
- Special purpose outlets for fixed equipment and appliances.
- Telephone, inter-com, hi-fi and TV outlets and raceways.

Behind the Outlets

Behind the utilization layout, wiring system capacity developments are less apparent but even more significant. Circuiting is usually designated only by a "riser" diagram and/or a circuit schedule. Mains are at least 100-amp; often 150-amp or larger, when air conditioning or electric heat are included.

Modern design requires that the major service entrance component provide for a large margin of capacity in excess of immediate load requirements;

- to permit load growth, and
- to permit operation substantially below maximum capacity under all conditions.

Branch circuit distribution is almost always centralized at the service entrance which is likely to be located in the garage or utility room. There is a distinct trend away from the traditional basement meter board as a result of the use of outside meters and the trend toward finished basements.

A typical high capacity service will have three No. 1/0 service entrance conductors in conduit and two exterior meter sockets nippled through the wall to a distribution panelboard. The panelboard will contain six 240-volt, two-pole circuits for fixed equipment and mains with 18 or more single pole, 120-volt branch circuits. A separate 240-volt circuit within the panelboard or in a separate enclosure serves the water heater.

Practically all high-capacity jobs include provisions for air conditioning, whether equipment is installed at the time of building or not. Provisions vary from spare circuits in the panelboard to complete circuits and outlets. In any event the service entrance capacity anticipates full air conditioning or the equivalent in room units.

Outlets for unit room air conditioners are served from indi-

vidual special purpose circuits. Some installations connect more than one outlet per circuit with individual protective devices at each outlet.

Supplementary Heat

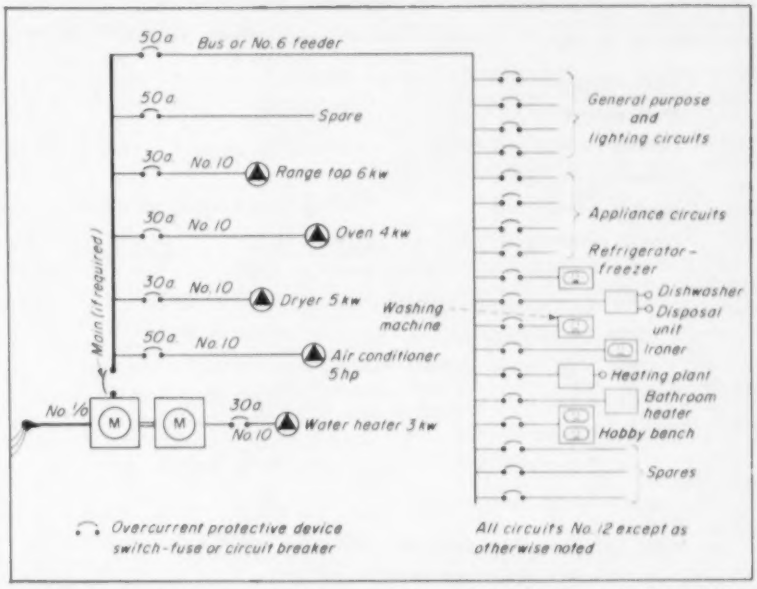
Supplementary uses of electric heat are fairly common in existing homes, but uses in new construction are appearing which indicate some opportunities which deserve careful consideration. A thermostatically operated bathroom heater is sized for the full heat requirements and the conventional heating equipment is omitted at a substantial saving in initial cost and space. The same method can be applied to kitchens to advantage.

Appliance Circuits

The traditional appliance circuit has been increased to a 3-wire circuit with one or more additional circuits in the kitchen counter area. A new device, the appliance center, with several receptacles and control features is gaining in popularity. In view of the rapid increase in the use of independent portable cooking appliances; broilers, rotisseries, fry-pans, deep-fryers, toasters, coffee-makers, sauce-pans, egg-cookers and waffle-makers as well as other electrically operated kitchen aids, the available capacity of four separate circuits or the equivalent in appliance centers is necessary for full utilization of these convenient and popular devices.

The trend toward built-in cooking components instead of the range has also affected wiring practice. Each unit is wired on its own circuit, usually No. 10's to the oven and 12's or 10's to the surface cooking units depending upon their rating. The built-ins are usually direct-connected with the cable looped to allow removal of the units.

Dishwashers and disposal units are direct-connected and both served by a special purpose circuit. A plug receptacle on an individual circuit is sometimes provided for the refrigerator-freezer. This is usually referred to as an isolating circuit since the load of a few hundred watts does not in itself require full circuit capacity. Its purpose is to prevent interruption of current to the refrigerator from faulty cords or appliances that might otherwise be connected



WIRING DIAGRAM of typical 150-amp service and distribution, including off-heat water heating and central air conditioning. Note use of special purpose full circuits for fixed and automatic appliances.

if there were other outlets on the same circuit.

Special purpose circuits are provided for laundry appliances; a 6 kw No. 10 3-wire circuit for the dryer receptacle (or combination washer-dryer), a 2 kw No. 12 2-wire circuit for the washer receptacle and a 2 kw No. 12 2-wire circuit for the ironer receptacle.

General purpose circuits for plug receptacles and lighting generally follow the Code recommendation of one circuit for each 500 sq ft. In planning practice, however, actual circuits are rarely indicated and layout is usually decided by the contractor.

The design of high-capacity wiring follows generally the recommendation of the Residential Wiring Handbook, the "load-matched" methods recommended in the shelter industry booklet of the "Live Better Electrically" industry program and the "functional" methods described by the editors of *Electrical Construction and Maintenance* ("How to Plan Functional Residential Electrical Systems", March 1955).

Other methods such as ring circuits and sub-feeders, with overcurrent protection at the outlets, have been proposed but are rarely used in house wiring in the United States.

Wiring methods vary with local or regional practice, local code rules and the requirements of the supplying utility:

- Branch circuits — Usually NM, NMC or armored cable. In some communities, for new home construction, EMT or rigid conduit. A minimum of No. 12 wire is advocated in many areas.
- Service entrance—SE, ASE, or rigid conduit for 100-amp or less. Usually conduit for over 100-amp. Some USE, non-metallic conduit or rigid steel conduit for underground.

The general considerations for functional wiring design requires anticipating the various types of loads which the system may serve, presently and for the future within the scope of practical planning. For this reason, it is usually necessary to provide for electrical utilization beyond the initial appliance and lighting installation which may account for only a fraction of the ultimate load.

The following loads should *always be provided* for in the initial electrical system:

Electric range or equivalent in components

TABLE 2

Typical Wiring System for Electric Resistance Heating

Total connected load	18 kw
Main service	200 amps
Heating main	100 amps
Heating main feeder	No. 2
Heating panelboard	8 2-p, 240-v, 20-amp circuits
Branch circuits	No. 12
Cir. 1 Living room — dining room	3500 W Th 1
Cir. 2 Living room — dining room	2500 W Th 1
Cir. 3 Family room	4000 W Th 2
Cir. 4 Kitchen — laundry — utility	1200 W Th 3
Cir. 5 Bedroom #1	2600 W Th 4
Cir. 6 Bedroom #2	1500 W Th 5
Cir. 7 Bedroom #3	1500 W Th 6
Cir. 8 Bath 1, 2	1200 W Th 7, 8

Notes: Th 1, Low voltage thermostat operates two relays
Th 2, Th 4, Low voltage thermostat and relays
Th 3, 5, 6, Line voltage thermostat, wall
Th 7, 8, Line voltage thermostat on equipment

Electric washer and dryer or combination
Dishwasher and disposal unit
Refrigerator—freezer
Bathroom heater, supplementary
Multiple circuits for kitchen appliances
Hobby bench circuit or circuits
Central air conditioning or equivalent in room air conditioners.

The following loads should *be considered* for the initial electrical system and provided for if there is reasonable probability that such equipment may be installed:

Electric water heating
Supplementary electric heating
Heat pump
Full electric space heating
Snow melting
Attic fan

It will be noted from the above list that wiring for air conditioning is no longer considered optional in modern new home construction over most of the United States.

The first four of the optional loads may be considered in context with the type of heating method employed:

All-electric homes would include electric water heating, and either a heat pump, a heat pump with supplementary resistance heating or full resistance heating. If heated by fuel-fired warm air, provisions should include electric water heating. If heated by fuel-fired steam, vapor or hot water, domestic hot water is supplied by the heating plant, and provision for electric water heating may be omitted.

No special provisions have been noted above for future electronic cooking equipment. Present information available about electrical requirements indicates that loads of high frequency cookers will probably not exceed the ratings of conventional electric ranges.

Accessibility

The accessibility of the wiring system is determined by the number and location of outlets for utilization. It should be possible to plug in and use any portable lamp or appliance wherever such devices would be normally used without extension cords.

The Residential Wiring Handbook calls for convenience outlets spaced so that no point along the floor line in any usable wall space is more than 6 ft from an outlet in that space. For kitchens, at least one outlet should be provided for each 4 ft of work-surface frontage with at least one outlet for each work surface. Special purpose outlets should, of course, be placed at the location of the appliance to be served.

While accessibility is usually considered separately from capacity, they are inherently related. The full circuit capacity is theoretically "available" at any outlet on the circuit. However, in practical use, when one or more outlets on the circuit are loaded to a substantial fraction of the circuit capacity, the accessibility provided by other outlets is effectively disabled. Thus while accessibility is an important characteristic of the system, it must be supported by ample circuit capacity.

Circuit Capacity

Circuit capacity is the key to safe and carefree operation. With an ample number of circuits, properly distributed, the probability of overloading under a condition of normal utilization can be practically eliminated. Circuit capacity is the most abused characteristic of conventional home wiring designs. Yet additional circuit capacity is the least expensive way of building the useful capacity of the system for the user.

The availability of ample circuit capacity is vitally important to good residential electric system design. While the maximum system capacity is limited by the service entrance, an overload on a service is relatively rare. Overloads on branch circuits are so common that many people accept them as a normal and inherent evil of house wiring.

Additional branch circuits, therefore, "open up" the electrical system for full utilization within the service capacity limits. Branch circuits, with proper distribution, are the best "bargain" in residential wiring. Useful system capacity can often be *doubled* for less than 10% of the wiring cost.

Isolation

Special circuits should be installed to serve certain types of automatic equipment which operate unattended. Heating plants, refrigerators, freezers and sump pumps are loads that should not be subject to accidental interruption by faults or overloads in other parts of the system. They should therefore be served by a circuit or

circuits to which other equipment cannot be connected.

Other special purpose branch circuits serving a single appliance are always recommended when the appliance is rated at 1 kw or more and is normally used at a fixed location. Automatic clothes washers, dishwashers, ironers, and unit air conditioners are types of equipment which should be served on individual circuits.

Power Centers

In recent years there have been substantial developments in service entrance equipments and residential panelboards, which in turn has greatly influenced wiring system layout. Almost any desired circuit array can be quickly assembled from inexpensive mass-produced components in standardized cabinets. There has been marked improvement in appearance and most residential equipments can be installed flush in the wall.

Such equipment may be installed conspicuously in the kitchen, laundry, utility room or front hall where they are readily accessible and close to the loads which they serve.

Location of service entrance equipment is controlled by the meter location, usually an outside corner. If all branch circuits are centered in the service entrance panel home runs must be long. If only the mains and the heavy duty appliance circuits are located at the service entrance, branch circuit distribution panels can be located at load centers permitting short home runs and encouraging the use of full circuit outlets and appliance connections.

Best location for the combined service entrance and distribution center is as close as practical to the kitchen, laundry and utility area, which in conventional house construction are usually combined or adjoining on the floor plan.

Electric Heat

Installations which include electric space heating are equipped with 150-amp or larger service entrances. Typical heat pump installations are 3, 5 and 7½ hp. They provide winter heating distributed through air ducts and also serve for summer cooling. Heat pumps often have supplementary resistance heating in the equipment.

Electric resistance heating installations usually involve heating cables imbedded in ceilings, electric baseboards, glass panels, wall fan or connector units. Application is "in-space" and involves no duct work.

Thermostat control is provided by:

- line voltage controls in each unit
- line voltage control in each room
- low voltage relay control for each room

Low voltage thermostats with relay control are capable of very accurate operation and by "anticipating" temperature change can compensate for the lag or inertia inherent in the heating devices. Relays are often grouped in a cabinet adjacent to the panelboard with one double pole relay controlling each branch circuit. Each room is supplied by one or two 240-volt 2-wire branch circuits. One low voltage room thermostat may operate one or more relays.

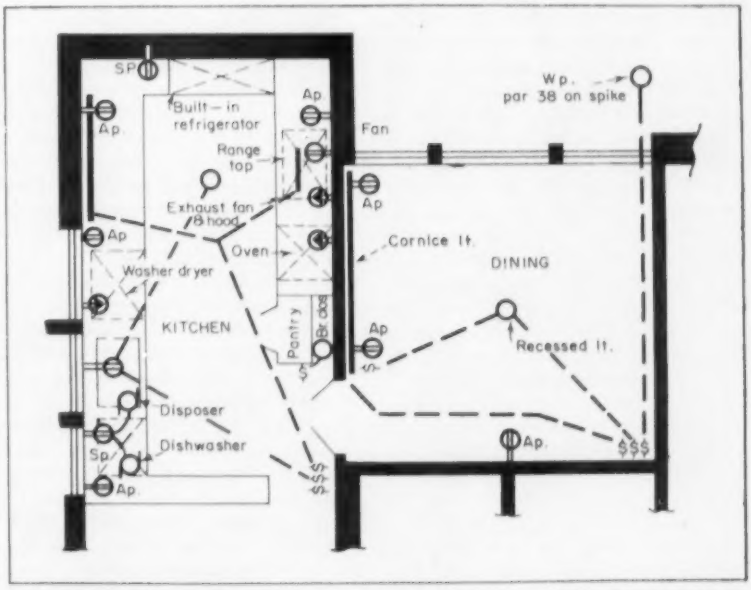
Branch circuits for heating are usually standardized at 20-amp, 240-volts with a continuous connected load capacity of 4 kw. This capacity is adequate for most rooms. One circuit may serve two or more small loads such as bathrooms. Larger capacity circuits are permissible; however, it is usually more practical to use two or more 20-amp circuits when requirements exceed 4 kw in one room.

Heating circuits may be served from the main distribution panel; however, it is often more convenient to use a separate branch circuit panelboard. Table 2 illustrates a typical 18 kw electric resistance home heating installation.

In addition to high capacity power facilities, many modern homes are wired for entertainment, communication and protective facilities. These include:

- Outlets and raceways for telephones.
- Intercom for kitchen and master bedroom to entrances.
- TV antenna outlets in recreation room and bedrooms.
- Outlets and raceways for hi-fi in recreation room.
- Automatic fire detection and alarm system.
- Entrance chime signals.
- Automatic remote operators for garage doors.

Provision can easily be made in the initial wiring for future equipment installations.



PARTIAL PLAN of a modern electrical home illustrates typical electrical layout in the kitchen and dining room. Phone and intercom outlets (not shown) are located on counter peninsula near wall.

Better Light for Better Living

Home owners, both existing and prospective, are today learning more and more about better lighting which can add tremendously to their joy of home life. This is a result, primarily, of the impact of many home lighting and home improvement programs, and of stepped-up home lighting promotion by lamp and lighting equipment manufacturers, electric utility companies, model home demonstrations, consumer and shelter magazine articles on home lighting, and others. And these programs, as now scheduled and planned, will continue to increase in scope and activity in the months and years ahead.

But in spite of all this education and promotion, only a very few home owners today have homes lighted much beyond the bare minimum of essential necessity. And few indeed are the homes that have lighting that is truly comfortable, glare free, and adequate in quantity for the more difficult seeing tasks that abound in every home, or lighting that provides artistic and decorative effects beyond a small percentage of what is possible and desirable.

There are many plausible reasons why home owners have not yet invested in lighting that is representative of today's technology and know-how. First of all, an adequate home lighting system represents a larger investment than most home owners realize, or have been accustomed to making for the minimum standard jobs that have been installed. Second, few home owners have ever seen home lighting systems which provide more than just a few of the quality lighting effects and results that are now possible. They must be shown these effects, and the many benefits of good lighting must be demonstrated and sold to them, in order to create the desire for these many lighting features by them. Furthermore, that desire for better lighting must be increased until it is stronger than the home owners' desires for other products and conveniences, such as automobiles, appliances, new furniture, rugs, draperies, other home modernization features and improvements—even new clothes, better food, and vacations. New lighting equipment is in competition with all other types of products, goods, and services.

There have also been many other factors that have retarded progress in home lighting. Architects and building contractors have given far too little attention to lighting—have installed a minimum of lighting outlets, a few convenience receptacles, and totally inadequate lighting "fixtures", mostly of the wrong type, and have passed on to the home purchasers the problem of selecting floor and table lamps to do the job. The residential lighting equipment manufacturers generally have also failed to face up to this opportunity until recently, by continuing to produce more or less the same old types of units they have been making for years, changed only by shapes of glass and plastics, metal trim, and finishes or colors. To spur sales, they have mass produced this equipment, created "package" deals for an entire home, and cut prices to bare bones so that trade channel profits also became unattractive. Both incentive, and financing for market promotion, disappeared.

Some creative and positive thinking has now changed this picture. Over the past two or more years the residential lighting industry has faced up to all these problems realistically. It has set for itself a new and clear objective. That objective is more and better lighting for homeowners—lighting with inherent comfort, quality, convenience and benefits. These are qualities which can be demonstrated and sold to homeowners, both existing and prospective. And experience has already proved this policy to be sound and practical. Over the past months while new home building has been declining in numbers, lighting equipment sales have been climbing. The producers have been designing new types of equipment which provide improved lighting and new lighting effects—quality features—and home owners have bought these features.

Residential lighting now faces a new and optimistic outlook. Many national, regional, and local programs are now in operation, and more are getting under way, all putting more and more emphasis on better home lighting for better living. In the months ahead the story of better light for better living will reach every home owner again and again. It is now squarely up to electrical contractors and dealers, with the aid and assistance of electrical distributors, electric utilities, and others to properly organize their facilities and services to courteously and efficiently meet this challenge, to display, demonstrate, explain and sell better home lighting to every prospective homeowner or housewife who makes an inquiry on lighting.

Guide to Better Lighting

Good lighting provides a comfortable visual environment and makes seeing easy. Some seeing tasks are more difficult than others, so that varying lighting intensities are required, depending upon the seeing tasks involved. Seeing tasks in the home vary greatly—from providing just enough light to enable one to go from one room to another at night (night lights), to sewing on dark goods (light for sewing). Home activities also vary greatly, and depending upon the size and makeup of the family, social and recreational habits, family routine, and similar factors. Also, all these activities and varying visual tasks are confined to the limited area of the house and its adjacent exterior areas. Thus, if this house is to be lighted properly and effectively for each seeing task and activity, the lighting system must be extensive, variable, and flexible.

There are many home lighting devices which have been designed expressly to solve specific home lighting problems, and many which may be used to solve several general lighting problems. The well planned lighting system incorporates the right unit in the right place, of proper size and equipped with the proper lamp bulb. In new homes it requires the coordinated work of the architect, the lighting

engineer, and the decorator or home owner. Some broad but brief guidance in equipment selection for the principal areas of the average home are presented below.

Living Room

Two types of lighting are needed in the living room—general area lighting, and local lighting. Several sources of light are desirable, and flexible control by switching or dimming is highly desirable. Size of room and furniture grouping will influence number of units, type, and location.

General area—One ceiling unit for small room, or two or more ceiling units for large room, may be used. If luminaires are used, these should be indirect, or large area extra low brightness type. Indirect-lighted coffers or recessed domes about 3 ft in diameter with attractive diffuser bottoms are also appropriate. About 20 lumens per sq ft of area should be provided, preferably dimmer controlled.

Portable floor and table lamps located around the perimeter of the room may also be used in lieu of the ceiling units. These will provide both general and local lighting, depending upon placement.

Window walls—Lighted valances over windows continue the same decorative mood as that established during the day when daylight enters the windows. By mounting the valances down from the ceiling a desirable upward component of light adds a pleasant cove effect and maintains a better visual environment.

Interior walls—Use of a lighted valance, lighted wall bracket (valance type) or lighted cornice (valance against ceiling) on interior walls wash the walls with light, help to make the room look larger, and ties in with window valance lighting. These provide good lighting around room perimeter, eliminate the need for portable lamps.

Murals, pictures — Recessed ceiling units with prismatic lenses providing asymmetric light distribution, or recessed pinhole spotlights, are effective in lighting murals or wall mounted pictures and paintings. Semi-recessed or surface installed ceiling reflector lamp units may also be used.

Decorative lighting — Lighted ornaments on wall and end tables, or lighted wall niches, are particularly effective for low intensity mood lighting. Ceiling recessed pinhole spots over flower arrangements, coffee table, statuary, etc., also add a dramatic decorative touch.

Miscellaneous — For corner sofa-table groupings a ceiling mounted pull-down type unit, or a large area ceiling recessed unit over the table provides general lighting over this setting. A desk against a wall area can be lighted by a fluorescent wall-bracket unit. Ceiling recessed lens units are suitable for lighting built-in book cases. And one or more night lights should be placed near doorways.

Dining Area

Location and size of dining area will influence the lighting arrangement. If adjacent to or part of the living area, the lighting should complement and harmonize with the living area lighting. If a separate dining room, it may be treated individually.

Over table—Three methods are appropriate: 1) use a single multilamp pull-down type luminaire ceiling mounted over the center of the table; 2) use a large area low brightness ceiling recessed unit with attractive diffusing medium centered over the table; or 3) use one or more ceiling recessed pinhole type spotlights.

In a breakfast nook, or small dinette area a ceiling recessed down light, or a ceiling mounted direct-indirect type suspended luminaire, centered over the table, is excellent.

General area—In a dining room, general lighting is also desirable in addition to the lighting over the table. Valance lighting over the windows is good, plus wall bracket (valance) lighting on interior walls. Indirect wall urns on side walls are also appropriate.

Dimmer control or dual control switching for the table lighting units is desirable.

Halls

The size of hall areas will influence the size and style lighting units used. Lighting may be by luminaires which harmonize with furnishings, or built-in units. Luminaires placed near stairs should be of the closed top-type.

Entrance hall—Lighting in this area should express warmth and graciousness. A ceiling luminaire or recessed unit providing 2000 lumens will provide general illumination. In large areas, lighted ornaments on side tables, or lighted wall niches add charm and decoration. Use one night light.

Vestibule—A ceiling luminaire or small recessed unit providing 1000 lumens is appropriate. Also use one night light.

Hallways, passageways—One or more ceiling luminaires, each providing 1000 lumens, are appropriate depending on length. Recessed units at 6-ft intervals may also be used. Use one night light.

Stairways—Ceiling luminaires in halls, if properly located, will provide light for stairs. Step shadows should be avoided. Use recessed ceiling unit, properly placed to prevent shadows, if necessary. Use a night light at head and foot of stairs.

Kitchen

Good lighting of high intensity is most desirable in the kitchen. Both general lighting and local lighting are needed. Size of kitchen will influence selection of equipment for general lighting, but quality of light should not be sacrificed on account of size of area.

General area—Provide 40 to 50 lumens per sq ft minimum for general lighting, which may be switch controlled for two-level intensity if multiple lamp units are used.

A luminous ceiling provides ideal lighting for the kitchen. It may be approximately wall-to-wall, or a large luminous area centered in the room. Recessed or ceiling surface mounted 4 by 4s, 4 by 2s, or 2 by 2s with formed plastic diffusers are also suitable, as are recessed bowl silvered lamp units with louvers, or with plastic or glass diffusers. Recessed single-lamp troffers with glass or plastic panels are also acceptable.

Sink—Concentrated direct light from incandescent lamp units recessed in ceiling soffit over sink provides high intensity illumination at this point. Prismatic glass lens units which provide a band of light along sink area are preferred,

Recommended Lighting Practice for the Home

AREA	LIGHTING	Recommended Wattages	
		Minimum	Good Practice
EXTERIOR			
Driveway	Post lanterns (1 or 2)	100	400
Yard	Floodlights (2 or more) in overhang or on side of wall close to roof.	300	600
Main entrance	Wall lanterns (1 or 2)	100	150
	Illuminated house number	10	25
	Step lights (1 or more)	25	100
Other entrances	Wall lantern (1)	50	100
ENTRANCE HALLS			
Large Foyer	Ceiling, table lamps	175	350
Vestibule	Ceiling	60	100
Stairways (each)	Ceiling, night lights	110	160
Hallways (each)	Ceiling, night lights	110	160
Closets (each)	Ceiling or wall	40	75
LIVING ROOM			
General area	Ceiling (1 or 2)	100	400
	Portable lamps (1 to 5)	150	750
Window walls	Valances or cornices	80	240
Other walls	Ceiling recessed units for murals, paintings, etc.		
	Decorative lighting units		
	Night lights	10	30
BEDROOMS			
General area	Ceiling (center)	75	180
Bed	Wall bracket, or cornice	25	40
Windows	Valances or cornices		
	Night light	10	10
	Portable lamps (vanity, etc.)	100	150
DINING ROOM OR AREA			
General area	Ceiling over table (Multiple lamps, 2 control)	195	320
	Valance, or cornice, or wall brackets	80	160
KITCHEN			
General area	Ceiling	95	300
Sink	Ceiling (over sink)	75	150
Range	Ceiling, or wall bracket	25	95
Work counters	Wall bracket, or ceiling (each)	25	150
Under cabinets	Reflector strip (continuous)		
	Night light	10	10
BATHROOM			
General area	Ceiling (1) and over tub (1)	150	225
Mirror	Wall bracket (2)	40	40
	Sun lamp (1 or 2)	275	550
	Night light	10	10
GARAGE			
Doorway	Wall, exterior over door	100	150
Interior	Ceiling (2 or 3)	180	300
OTHER AREAS			
Laundry	Ceiling, over work areas	100	300
Utility	Ceiling, and localized	.....	.....
Recreation	Ceiling recessed, wall mounted, etc.	.....	.....

but reflector lamps in metal housings, recessed or surface mounted, may also be used. A 2-lamp 4-ft long louvered troffer fluorescent unit, with polished aluminum parabolic reflectors, is also good.

Range—The range may be lighted by any of the units recommended for the sink, located in the ceiling directly over the range. A 2-lamp fluorescent wall bracket, installed at eye level, open at bottom or louvered, and closed at top by clear or diffusing type glass, is also suitable. Top of bracket may be used for spices, seasoning, etc., or for ornamental objects.

Work counters—Each counter should be individually lighted. For tables in center of room, general overhead lighting may be adequate. For counters at walls, direct lighting from ceiling directly overhead, such as used for sink lighting is suitable, or if counter is under a cabinet, continuous reflector strip with lamp shielded from room provides good work light.

Under cabinets—Use continuous reflector strip with reflector for shielding lamp from room, and install under cabinets at outer edge of cabinet.

A night light near each door, or recessed in an unobstructed wall space near floor, is desirable.

Bedrooms

Overall illumination with local lighting for reading in bed and at dressing table are the basic requirements for lighting the bedroom, which may be supplemented by light for decoration, and lighted ornaments. The general result should be cheerful, and pleasant.

General area—Center ceiling luminaire is best for providing overall general illumination, necessary for making up beds, cleaning room, and looking into dresser drawers. Provide 20 to 25 lumens per sq ft.

Bed—Light for reading in bed can be provided by installing fluorescent wall bracket (valance type) about 30 in. above mattress, also by cornice at ceiling on wall behind bed. Night tables are best lighted by concentrated spotlights recessed in ceiling directly over tables, with switch control on wall beside bed headboard.

Windows—Valance or cornice lights over each window are effective as decorative treatment, also add to general illumination.

Portable lamps may be used, if desired by home owners. Two vanity lamps provide ideal illumination on dresser. A floor lamp near an easy chair provides light for reading when desired. Use night lights in walls near doors.

Bathroom

The bathroom should be well lighted, using both general illumination and local lighting. In addition, a night light should be provided, and an ozone lamp installed on wall is desirable. Convenience outlets are needed for electric razors and for sun lamps. Two wall mounted sun lamps, on adjustable brackets, one on each side of mirror but near the ceiling, are preferred.

General area—Provide plenty of general illumination, using a luminous ceiling, a large area low brightness unit, a ceiling recessed bowl silvered lamp unit, or other similar ceiling luminaire.

Over tub or shower stall, install a vaportight incandescent unit on ceiling.

Mirror—Two bracket lights are called for, one on each side of mirror, of the elongated tubular lamp (fluorescent or incandescent) type. Use brackets which keep brightness as low as possible, and large enough to provide plenty of light. An innovation is a lens spot to project light upwards for shaving under chin.

Recreation Room

The decorative treatment of this area, its size and shape, and uses made of it, will guide in the selection of lighting for it. In general, this room should be provided with a variety of lighting effects, with a wide range of lighting intensities suitable for activities ranging from lounging and TV viewing to the playing of games, such as table tennis, cards, dart throwing, etc. Since ceilings are usually quite low, recessed shallow type units of the large area low brightness type are usually preferred. Fluorescent wall bracket (valance type) lighting is excellent for perimeter lighting. Surface mounted adjustable ceiling spot and flood lamp units are ideal for lighting dart target board, wall pictures, murals, etc. The pull-down type ceiling luminaire is suitable for corner table and sofa groupings. Self-lighted wall cabinets, illuminated wall niches, and lighted ornaments add a decorative touch for low level mood lighting. Multiple switch controls or dimmers aid greatly in providing flexibility to the lighting in this area.

Utility Areas

Industrial type reflectors are well suited for lighting utility areas. Fluorescent lamp reflectors should be two-lamp type, either with lamps adjacent, or end-to-end in single lamp reflector strip. Shielding is desirable. Bowl silvered incandescent lamps in reflector domes are also suitable for utility lighting.

Laundry—Install reflector unit 4 ft above laundry equipment. One unit is adequate for washer and dryer.

Ironing—Use one reflector 4 ft over ironing machine or ironing board. Daylight lamps are preferred for ironing, as they show up scorches easily.

Utility room—Ceiling mounted reflector is satisfactory, using 200 watt bowl silvered lamp. Install local lighting, if needed.

Workbench—Standard fluorescent industrial reflectors, equipped with louvers or shielding are preferred.

Garage—Maximum convenience and safety is provided with a ceiling mounted reflector unit on each side of car 6 ft back from front bumper. Provide convenience outlet for portable hand lamp. A bracket light on outside wall over doorway, preferably with wide spread type lens refractor, provides light for traveling between garage and house, and night lighting for protection.

Exterior

Exterior lighting may range from a modest installation for safety and utility, to a highly elaborate system complete with decorative garden and yard lighting for outdoor living. A wide variety of lighting techniques and decorative treatments are available for those who may want to consider it. Only the basic practical exterior lighting techniques are given here, which apply to every home.

Driveway—Newel post lanterns of appropriate style and design, are appropriate. Two at entrance and two at exit are desirable, but may be limited to one at each location, or even to one at entrance only, if necessasry. Floodlighting of entire driveway is practical, if suitable location is available for concealing the floodlights.

Yard, or lawn—Floodlights or wide spread weatherproof lens units installed high on side walls or in the roof overhang around the entire house are suitable for lighting the yard or lawn. This type lighting is excellent for protection against prowlers, and for outdoor parties and summer outdoor activities at night.

Front entrance—Plenty of light at the front entrance creates a cheerful appearance and extends a cordial welcome to guests. Wall brackets, one on each side of door, are customary practice. If steps extend out from doorway, step lights or low newel post type units, provide light for safety. An illuminated house number should be provided and be kept turned on at all times at night.

Other entrances—A single wall bracket is adequate for side and rear entrances, placed on the side adjoining the door lock. If several steps exist, some type of step lighting is also called for.

Patios—Outdoor living is creating a demand for patios. These can be lighted by floodlights, and by low level opaque top pedestals. Roofs of colored Alsynite and similar transparent materials can be floodlighted from above and provide unusual color effects.

Light Sources

In general, fluorescent lamps used for home lighting, other than for utilitarian areas, should be of the warm white deluxe type. Standard white lamps are satisfactory for utility areas.

A wide variety of incandescent lamps are suitable for home lighting. Reflector lamps have many applications, especially for spot and flood types of light distribution. Tinted lamps may be used in many locations, if the home owner likes the resulting lighting effect.

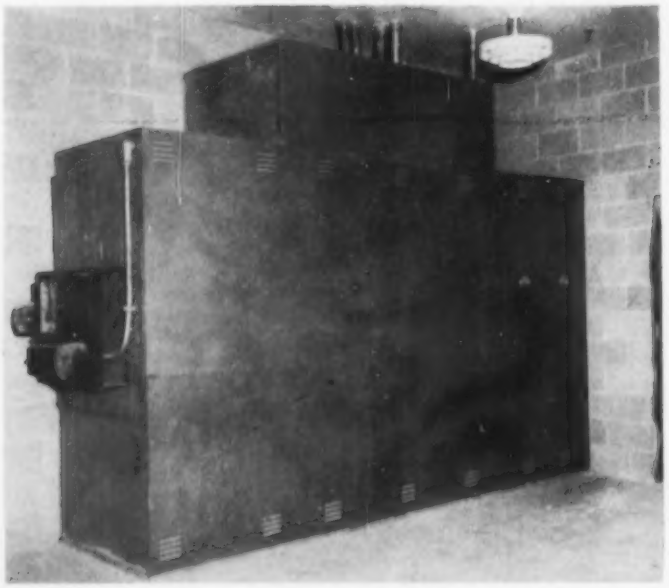
Generally, all light sources should be completely concealed from view at all normal viewing angles, including fluorescent lamps.

Contractor Provides . . .

Tailored Electrical Distribution

for new printing plant and office headquarters of Commerce Clearing House, Inc., in Chicago's northwest side. Design and installation by Continental Electrical Construction Co., effectively uses transformers and built-in load-center to meet multi-voltage needs of existing and new equipment.

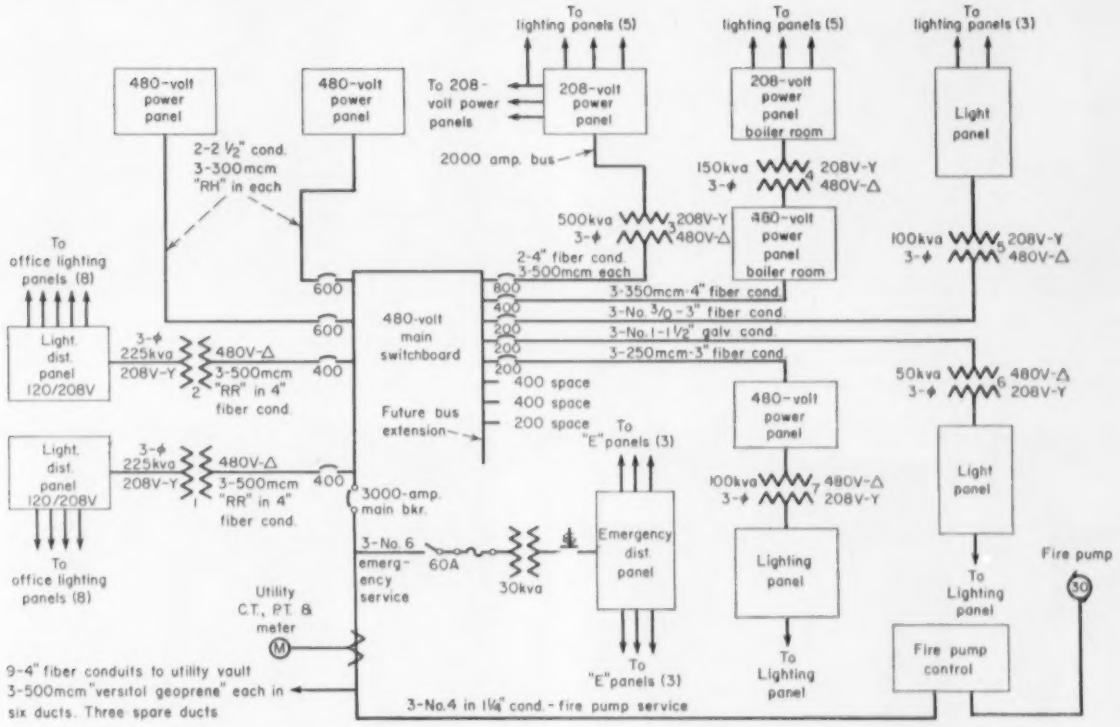
FLUSH FRONT OF main 480-volt distribution board in plant corridor. Here, 3,000-amp service is divided into 12 480-volt, 3-phase feeders to office and plant areas.



BACK OF MAIN board extends into work room. All panels can be quickly removed for service and maintenance. Louvers provide ample ventilation.

AN ELECTRICAL distribution system tailored to the specific needs of a lessee was an integral part of a new office and plant constructed to house the law-reporting service operations of Commerce Clearing House, Inc., Chicago. The two-story office building and sprawling one-story plant were designed by architect Arthur M. Heda and built by J. Emil Anderson & Son, Chicago, to provide the expanded facilities needed by CCH operations and still leave room for future growth.

The same foresight was used by Continental Electrical Construction Co., who designed and installed the complete electrical system. One additional problem was presented: the electrical system must accommodate existing 220-volt equipment, new 440-volt machinery, conventional lighting systems, and an array of office machines. Continental engineer Will Liebow solved this by selecting 480 volts, 3-phase, as the basic distribution with



DISTRIBUTION DIAGRAM for power and light. Note use of air-cooled transformers to obtain required utilization voltages.

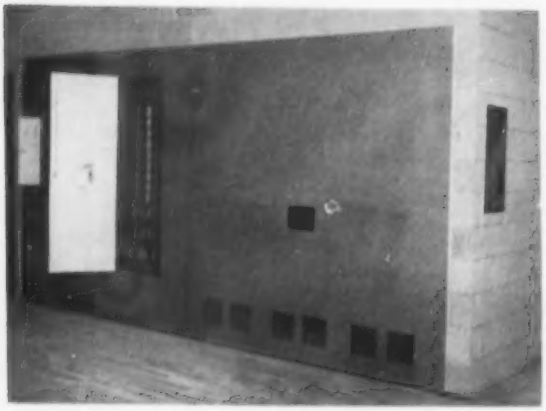
strategically located dry-type, 3-phase, step-down transformers to provide 120/208 volts for existing machinery, lighting and office area electrical loads. Where construction permitted, and load concentration demanded, large transformers were combined in unit-substation fashion with flush-mounted distribution panels. Branch circuits were installed in electrical metallic tubing concealed in suspended ceilings, underfloor in conduit or metal underfloor duct systems depending upon the area served and number of floor outlets desired.

Service from the utility outdoor vault comes underground in nine 4-in. fiber conduits which terminate at the main 480-volt distribution board. Six of these ducts contain three 500-MCM conductors each. Three ducts are spares.

The main board, flush-mounted in a corridor wall in the main plant area, extends into a work room providing easy access for installation and maintenance of circuit breakers and feeder cables. It contains a 3,000-amp main, 3-pole, 480-volt breaker plus the following 3-pole feeder breakers: one 800-amp, two 600-amp, three 400-amp, and three 200-amp units. Space is provided for two 400-amp, and one 200-amp units; also for future bus extension. Two circuits are taken off ahead of the main breaker. One goes to a 30-kva transformer for an emergency distribution center which feeds six emergency panels throughout the building. The other feeds a 30-hp gravity tank pump used for fire protection.

The feeder (two 4-in. underground fiber ducts) from the largest breaker (800-amp) goes direct to a 500-kva, 3-phase, 480/120/208-volt, air-cooled transformer to serve existing 220-volt equipment in the press room area. Associated lighting and power distribution panels are incorporated in a free-standing, unit-substation-type assembly the face of which is mounted flush in a wall separating the bindery and press room. The back of the cubicles extend into the press room and contain three additional power panels. Forced-air ventilation keeps the transformer cool. A metal duct ties the top of the transformer enclosure to a ceiling duct equipped with an exhaust fan which draws air in through front and back louvers at the base of the transformer.

Two substantial blocks of 480-volt power are served directly by separate feeders from the main board to the power panels. Where power needs are mixed, the feeders terminate at column load-centers and step-down, 3-phase, air-cooled transformers ranging from 50-kva to 150-kva size. At these locations, 3-phase power panels are connected ahead of the transformer with the combination 120/208-volt panels on the load side of the transformer. Secondary circuits serve the immediate 220-volt power and 120-volt lighting requirements.



BUILT-IN TRANSFORMER and distribution center in plant area is mounted flush in wall. 500-kva, 3-phase, air-cooled transformer at right serves flush power and lighting panels. Small panel in right wall is for emergency lighting.

METAL CUBICLES of 500-kva unit-substation-type distribution center extend into press room, contains three power panels in addition to those on flush front. Metal duct (arrow) in corner connects to ventilating system, cools transformer.

TRANSFORMER CLOSET in office area (one of two) houses a 225-kva 3-phase, 480/120/208-volt, air-cooled unit; serves flush-mounted lighting distribution center at left. Primary and secondary cables are enclosed in trough at left of unit.

CABLE THROUGH ASSEMBLY around office transformer contains primary and secondary conductors and conduit tie between secondary side of both transformers for emergency use. Louvered, hinged, double doors enclose area.

Two electrical closets in an office inner wall house the transformers serving the two-story office structure. Each contains a floor-mounted, 225-kva, 480/120/208-volt, 3-phase, air-cooled unit. Inverted, L-shaped, metal wireways carry the 480-volt feeders from the underground ducts to the transformer leads. Secondary feeders in the same wireways go through conduit connections to two distribution panels flush-mounted in the wall between the two closets.

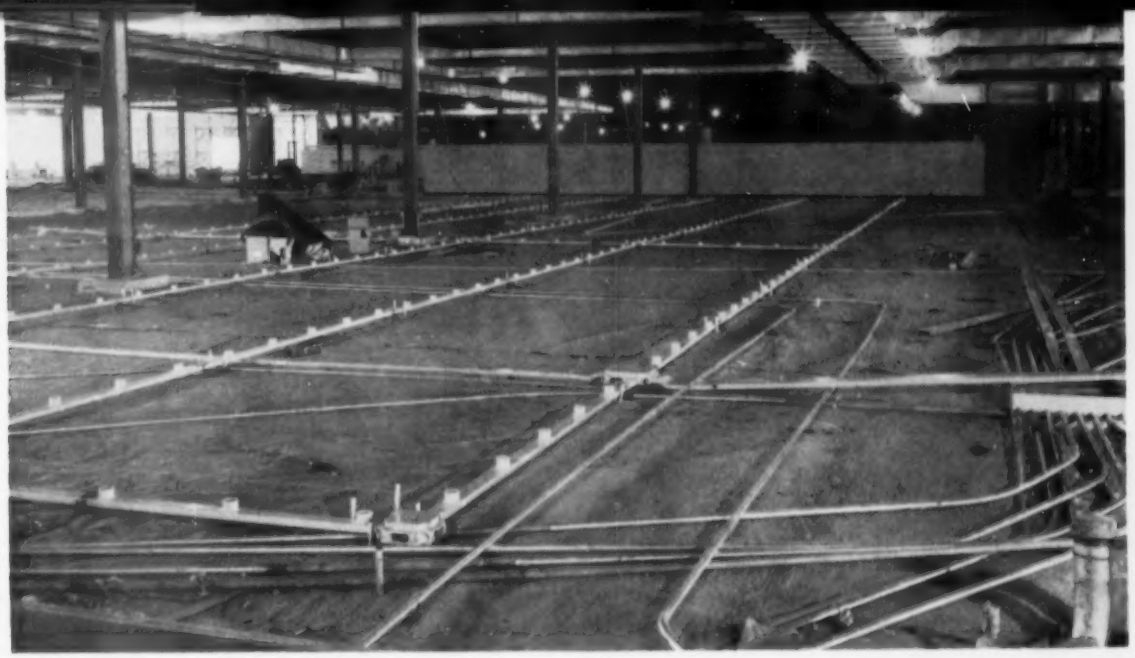
A spare conduit connection between the two transformer secondaries permits emergency installation of cable-ties in case one unit fails. The second transformer then would take a reduced portion of the entire office load.

Both closets are enclosed with hinged double-doors containing louvers. Duct connections to the building ventilating system draw air over the transformers from the door louvers and exhaust it through the ceiling. Walls and ceiling were treated with sound-conditioning materials to minimize transformer noise.

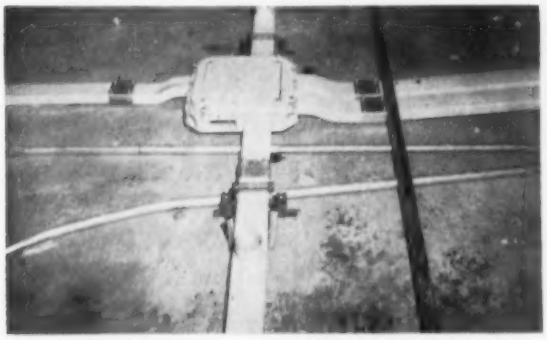
Branch-circuit flexibility in the office areas is provided by a network of dual, metal underfloor duct featuring large-area, cast-aluminum junction boxes. A similar network of single and dual underfloor duct lines, as well as buried conduit raceways, carries 120-volt and 208-volt circuits to equipment in the bindery and adjacent plant area. In ground-floor areas, the duct system was installed on top of a paper-backed moisture barrier laid on the dirt fill. Adjustable saddle brackets were used to support the duct at screed level.

To keep within the limits of slab thickness in the plant area, offset sections of underfloor duct were installed where conduit raceways and duct runs crossed each other. This technique saved a number of headaches where conduit stubups to columns came in close proximity to underfloor duct lines. Special large-area pull boxes, mounted directly underneath distribution panels, provided a common terminus for combinations of underfloor duct and conduit branches.

As installed, the complete electrical system at Commerce Clearing House more than meets the existing requirements of expanded operation. Beyond that, the design incorporates basic facilities for a substantial increase in electrical load.



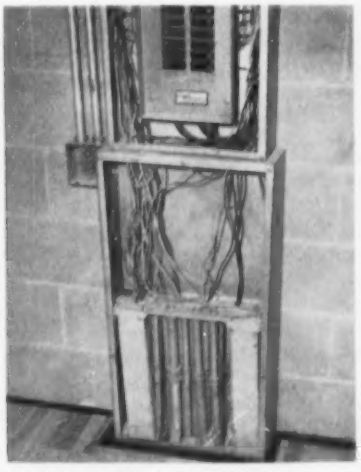
UNDERFLOOR DUCT network in plant area has single and dual lines for branch circuit flexibility. Duct and conduit raceways terminate at floor pull-box (right) under the built-in 500-kva unit-substation location.



JUNCTION BOXES of underfloor system are of the large-area, cast-aluminum type with square top access on adjustable cover ring. Note offset-sections used to carry duct under conduit.

DUCT SADDLE clears conduit stub-up at column line, keeps raceway crossover within slab depth. Underfloor duct was cut to length at job site with metal-cutting band saw.

COLUMN LOAD CENTER combines a 100-kva, 3-phase, air-cooled transformer (rear) and large distribution panel (front) fed by connecting trough on underground feeder.



SUPPLEMENTARY CABINET with open bottom and mid-point metal template serves as pull box and raceway terminus for conduits and underfloor duct under lighting panel.

ADJUSTABLE BRACKETS raise or lower duct lines to screed level. Dual-line duct system in ground-floor office area is installed above paper-backed moisture barrier laid on dirt fill.

McGraw-Hill and NEMA Sponsor

Lighting competition

Prizes total $5400 for 120 awards, is open to all who design, specify, sell or install lighting systems, and covers industrial, commercial, institutional, residential and outdoor lighting installations of all types.

A NEW lighting competition has been announced which promises to be the biggest and most popular in the history of the lighting industry. It opens officially on March 15, and closes October 25, 1957, and is international in scope. It is sponsored by McGraw-Hill electrical publications—*Electrical Construction and Maintenance*, *Electrical Wholesaling*, and *Electrical World*—with the cooperation of the National Lighting Bureau of the Commercial and Industrial Lighting Equipment Section, National Electrical Manufacturers Association.

Cash prizes totaling $5400.00 are offered for 120 separate awards. In addition, honorable mention awards will be made for meritorious entries which do not receive cash prizes. Announcements of the competition are being made in the March issues of the three sponsoring McGraw-Hill publications, giving full details including the official rules.

Lighting Jobs Eligible

In general, all types of indoor and outdoor electric lighting installations for utilization or decorative purposes, which have been completed on or after January 1, 1956, or are completed on or before October 25, 1957, are eligible for entry. As listed in the official rules, these installations include:

1. Industrial lighting
2. Store lighting
3. Office lighting
4. Institutional lighting
5. Outdoor lighting
6. Residential lighting

Contest entries may cover complete lighting installations, such as for an entire store, school, or home; or may be limited to specific areas within a complete project, or to a simple lighting technique. Both new and relighting projects are eligible.

This competition is open to individuals only. Therefore entries are to be submitted by individuals in their own names, and not in the names of the firms for which they work. These individuals, however, must be regularly engaged in the design, specification, sale or installation of lighting systems, or employed by a firm that is so engaged. Thus the contest is set up with four classifications for contestants, which the rules designate as Contestant Divisions, as follows:

a. Electrical Contractor
b. Electrical Wholesale Distributor
c. Architect or Engineer
d. Electric Utility

Under each Contestant Division identical cash prize awards are offered for each of the six classifications set up for lighting installations. By using this method the contestants of any one Division are not competing with the contestants in any other Division, and the competition in essence becomes four contests in one. However, joint entries may also be made on the same lighting installation by two or more contestants, with each contestant from a different Contestant Division.

A total of $5400.00 in cash, covering 120 prize awards, is offered in this contest. These awards are divided equally among the four Contestant Divisions, at $1350.00 in cash for 30 prizes, and put each Division on an identical prize basis. Further, each of the six lighting Installation Classifications are treated identical from the standpoint of prizes, and five cash awards are offered for each. These five awards are:

First Prize	$100
Second Prize	50
Three Prizes @.....	25 each

Winners of cash prizes will also receive award certificates. Honorable mention awards, to be given to meritorious entries which are not awarded cash prizes, will receive certificates only. In addition, any entry (which receives a cash prize or honorable mention award) in either of the four Group A installation classifications will be certified by the National Lighting Bureau—NEMA, and a certificate

issued to the owner of the lighting installation, *provided* such installation plans meet certification standards of the Bureau.

Awards will be presented to winning contestants as soon after the announcement of award winners as possible and practical. In general, an effort will be made to have all awards presented at some appropriate local electrical industry function held in each winner's own locality.

Judging of Entries

All entries will be judged in New York City on November 5, 1957. The sponsors have arranged for nine well known authorities in the field of lighting to serve as judges. These nine authorities will form three panels of three judges each, and each panel will handle the entries in a specific field of lighting. Thus the six lighting installation classifications have been divided into three groupings for this reason—Group A, covering industrial, store, office and institutional lighting; Group B, covering outdoor lighting including street and highway and floodlighting; and Group C, covering residential lighting.

The sponsors have developed and announced five factors which the judges will consider in judging the entries. This has been done, the sponsors state, to simplify the preparation of the entries by the contestants, and the judging of the entries by the judges. These factors are: 1) sales effort; 2) lighting adequacy; 3) lighting quality; 4) artistic appearance; and 5) customer benefits.

Postwar Lighting Programs

In the past twelve years, and beginning with the termination of the war, several groups associated with the lighting industry have made worthy contributions to lighting progress, and to the development of higher lighting standards and of new and larger lighting markets. These groups include the Illuminating Engineering Society, the electric utility companies, lighting equipment manufacturers, light source manufacturers, lighting accessories manufacturers, industry magazines, and others.

One of the early postwar industry-wide programs was the Planned Lighting program, which has been adopted and sponsored by electric utility companies. It is based on the premise that every lighting job should be "planned" by a qualified lighting engineer. Thousands of lighting installations have been made under this program, all "planned" to meet the customers' specialized requirements. This program is still in operation.

Another program that was developed and launched initially in 1946 was the International Lighting Exposition and Conferences. Object of this program was to provide, at one time and place, exhibits of new and modern lighting equipments, light sources, and lighting accessories—for inspection by owners, architects, engineers, electric utility representatives, wholesalers, electrical contractors and dealers, plant engineers and others. Four of these Expositions were held, at intervals of 18 to 24 months, in 1946, 1947, 1949 and 1952. As an added interest, a lighting contest under the title of "Merit Award Competition" was conducted in parallel with these Expositions. These four shows were sponsored and operated under the direction and management of the Commercial and Industrial Lighting Equipment Section of NEMA.

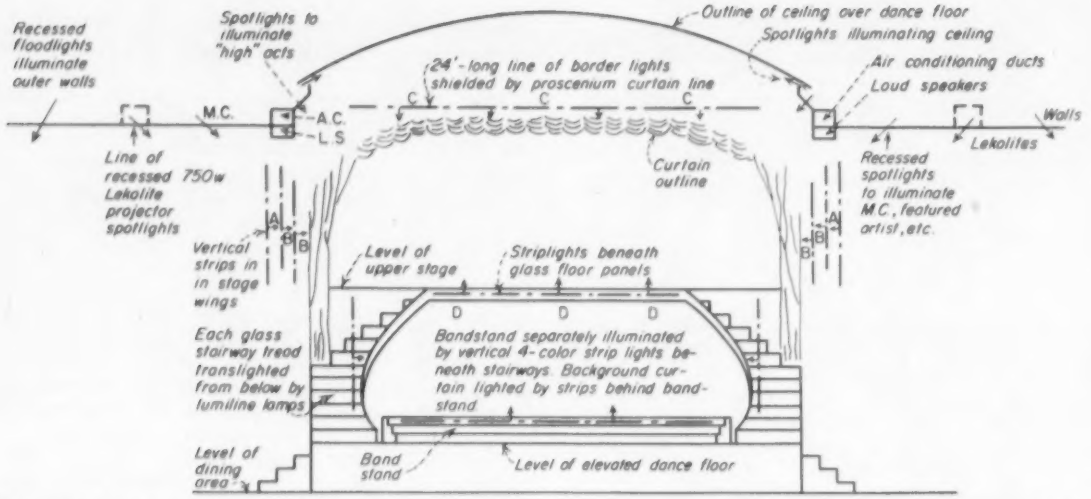
The Illuminating Engineering Society, through its Lighting Service Section, has developed and sponsored a lighting competition which is now national in scope. This contest is titled "My Most Interesting Lighting Job", and is open to the IES membership. These contests operate on the elimination basis, starting at the local Section/Chapter level where all but one contestant is eliminated. This winner proceeds to the Regional conference where all but the winner is eliminated. The final ten Regional winners go to the annual National conference for the final runoff. These contests help the Society to achieve its objective of "dissemination of lighting knowledge" in that the entries are presented by the contestants before the membership at each stage.

The International Lighting Expositions were discontinued in 1951. *Electrical Construction and Maintenance* thereupon announced and sponsored two lighting competitions for electrical contractors. The first was held in 1953, the second in 1954. These two competitions were planned to keep alive and active an interest in lighting promotion by electrical contractors during the interim period while the Commercial and Industrial Lighting Equipment Section of NEMA was studying and developing a new program which would better meet industry needs.

The new program developed by NEMA is the Certified Lighting program. NEMA has set up its National Lighting Bureau to administer this new program. The Certified Lighting program operates from the "grass roots", so to speak. That is, it begins at the electrical contractor level, where the contractor is already in direct contact with the ultimate users of lighting. This program embraces broad training of electrical contractors in the fundamental technical aspects of lighting practice, and in practical sales methods. These local training programs are set up under the jurisdiction of Local Lighting Bureaus, which in turn set up local certifying agencies to handle certification of lighting plans for the contractors. Local Lighting Bureaus are now in operation in 18 major trading areas throughout the United States, and the training courses have proved so popular that they have also been made available to other segments of the lighting industry.

The 1957 International Lighting Competition is a joint venture between the three McGraw-Hill electrical publications and the National Lighting Bureau—NEMA "to foster and encourage the design, sale, installation and use of better lighting for maximum seeing comfort in the home, at work and at play; and to stimulate greater interest and activity toward continuing progress in electrical illumination".

With the tremendous strides in lighting progress that are being made today, in light sources and lighting equipments, in lighting systems and lighting techniques, there are thousands of outstanding lighting installations which reflect that progress. All of these lighting installations are eligible for entry in this new Competition. The contest sponsors plan the widest possible publication and dissemination of the winning entries, which will help to spur on lighting progress to even higher goals.


Recessed floodlights illuminate outer walls
Spotlights to illuminate "high" acts
Outline of ceiling over dance floor
Spotlights illuminating ceiling
24'-long line of border lights shielded by proscenium curtain line
Air conditioning ducts
Loud speakers
M.C.
A.C.
L.S.
Walls
Lekolites
Line of recessed 750w Lekolite projector spotlights
Curtain outline
Recessed spotlights to illuminate M.C., featured artist, etc.
Vertical strips in in stage wings
Level of upper stage
Striplights beneath glass floor panels
Each glass stairway tread translighted from below by lumiline lamps
Bandstand separately illuminated by vertical 4-color strip lights beneath stairways. Background curtain lighted by strips behind bandstand
Level of dining area
Band stand
Level of elevated dance floor

ELEVATION of 2-level stage indicates relative positioning of Lekolite projector spotlights, "high act" spots, stage wing strips, proscenium borderlights, stairway and apron lighting installations. All light sources shown in this drawing are 4-color circuits remotely controlled from either of the two C-lectochrome electronic consoles.

Color Harmony Guaranteed with . . .

ELECTRONIC LIGHTING CONTROL

Pace-setting mag-amp "C-lectochrome" lighting control system regulates color hue, saturation and brightness in nation's largest nightclub. Impressive dimmer installation also permits single-lever activation of complicated 94-circuit pre-set lighting patterns. Unique design feature prevents combination of clashing color values

By Rollo Gillespie Williams

Color Consultant
Century Lighting, Inc.
New York, N. Y.

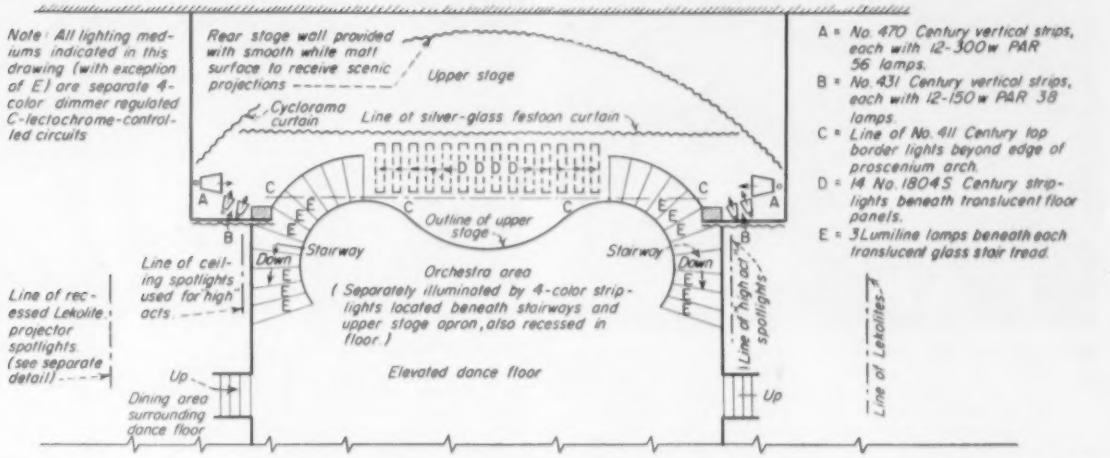
ONE of the nation's newest, largest and most spectacular nightclub lighting installations is currently drawing rave comments from normally staid Bostonians who are flocking to "Blinstrub's Village"—a mammoth afterdark restaurant-funspot having the capacity for serving 1700 patrons, the reputation for staging top-flight entertainment, and, now, the capability for bringing a rainbow indoors in every conceivable combination of color hue, saturation and brightness.

Cold statistics related to this topically "hot" installation are impressive; such as 100,000 watts of connected load (i.e., 100w/sf) . . . a 3-ton, 15-section dimmer bank . . . 94 remote-control circuits . . . two separate control centers . . . plus hundreds of flood- and spotlights, most of which are in the 750-watt bracket.

Heart of the installation is Century Lighting's new "C-lectochrome" magnetic amplifier electronic dimmer system that permits an operator to create literally thousands of color combinations by blending, dimming or intensifying hundreds of red, blue, green and white light sources to obtain any desired effect. Control may be initiated from either one of two consoles; the main one located high in the central lighting gallery overlooking the stage, the other one placed conveniently in the orchestra pit for local control. From either location an operator can create a lighting pattern to match the tempo and mood of the music or the needs of a performer, varying these patterns at will or projecting any one of five complete pre-set lighting combinations merely by flicking master keys.

Pre-Set Lighting Patterns

These pre-set patterns reflect coordinated thinking during rehearsal of a new show, for all lighting schemes and sequences are carefully determined while an operator at the main console first blends the three primary colors in each bank of lighting units to create desired hues. He then blends


Note: All lighting mediums indicated in this drawing (with exception of E) are separate 4-color dimmer regulated C-lectochrome-controlled circuits
Rear stage wall provided with smooth white matt surface to receive scenic projections
Upper stage
Cyclorama curtain
Line of silver-glass festoon curtain
Outline of upper stage
Stairway
Stairway
Orchestra area
(Separately illuminated by 4-color striplights located beneath stairways and upper stage apron, also recessed in floor.)
Elevated dance floor
Line of ceiling spotlights used for "high" acts
Line of recessed Lekolite projector spotlights (see separate detail)
Dining area surrounding dance floor
Up
Down
Line of "high act" spotlights
Line of Lekolites
A = No. 470 Century vertical strips, each with 12-300w PAR 56 lamps.
B = No. 431 Century vertical strips, each with 12-150w PAR 38 lamps.
C = Line of No. 411 Century top border lights beyond edge of proscenium arch.
D = 14 No. 1804S Century striplights beneath translucent floor panels.
E = 3 Luminline lamps beneath each translucent glass stair tread.

PARTIAL PLAN of nightclub stage and dance floor shows location of lighting units beneath translucent stair treads and stage apron panels. By varying or contrasting color hues, saturation and brightness values of striplights in opposing stage wings, interesting shimmering effects may be projected upon a silver-glass festoon curtain.

white light with the primary colors to obtain desired saturation, diluting or intensifying each color until exact desires are satisfied. Next he regulates brightness values of the various lighting banks until the overall arrangement and effect completely interpret the mood of the contemplated orchestral presentation or staged act. And, when this final pattern has been approved, it is "locked" for future recreation. Five such pre-set patterns may be established and later projected by moving a single key. Since five such pre-set dimmer patterns may be cross-related to any one of five pre-set lighting-circuit arrangements, a total of 25 combinations are possible through pushbutton control.

In the event that more than five lighting effects are required for a complete stage show, additional patterns may be set up as the show progresses, with the operator adjusting the various dimmer levers in accordance with a pre-determined cue sheet, locking the pattern to one of the key switches, then pressing this related key when the next complete color scheme is called for. If he desires, the operator can also neglect the presetting mechanism entirely, creating and blending successive lighting moods by moving individual switches to gradually vary the hues, saturation and brightness of his patterns.

Guaranteed Color Harmony

Still another feature of the C-lectochrome system is the arrangement of "harmony levers" which, when thrown, automatically wash the stage from different angles with colors in harmony with whatever hues are predominating at that moment. Also, an overall color harmony set-up can be dissolved into the next pre-set pattern. In other words, clashing color combinations become impossibilities whenever this electronic "brain" is in command, and light-

Dimmer-controlled 4-color lighting circuits regulated from C-lectochrome consoles*

Location of lighting equipment	Number of control circuits	Wattage per circuit	Total loads in watts
Vertical strips in stage wings (A and B)	8 8	900 900	7200 7200
Border lights behind proscenium arch (C)	4	900	3600
Striplights beneath translucent panels in stage apron (D)	4	1400	5600
Lekolite projector spotlights recessed in ceiling (F)	16 8	2250 1500	36000 12000
Striplights in wings and floor of orchestra alcove	8 4	600 1650	4800 6600
Stage stairway and feature-act spotlights	8	1500	12000
Periphery units to illuminate walls of dining area	24	400	9600
	92 circuits		104,600 watts

* Note: Wiring between dimmer bank and each of two C-lectochrome control consoles consists of 36 No. 14 and 24 No. 22 cables.
Lighting in general dining area, cocktail lounge, "high act" banks, club entryway, kitchen and various service areas is separately circuited and controlled.

CENTRAL LIGHTING GALLERY, suspended from nightclub ceiling and directly facing the stage, contains main C-lectochrome console and four spotlights for following feature performers. Bank of 16 Lekolite projector spotlights are piperack-mounted along gallery parapet. Loudspeaker above console enables operator to follow music and cue his lighting patterns accordingly.

CEILING-RECESSED dimmer-controlled downlights (upper right) are equipped with 75-watt PAR 38 lamps. Star-shaped apertures provide interesting sky effect over dining areas, while pastel-tinted enclosures reflect various colors when viewed at angles. Liberally-sized pull and tap boxes facilitate installation, connection or rearrangement of circuiting.

ing effects which are fundamentally harmonious may therefore be created even by an operator who has little or no color sense.

These consoles—compact and functional as typewriters—literally place "fingertip lighting" at the disposal of the operator. And, together with miles of related wiring, basement-based dimmers and assorted lighting equipment, this unique $50,000 installation constitutes an electronically-controlled lighting medium which has no other known equal.

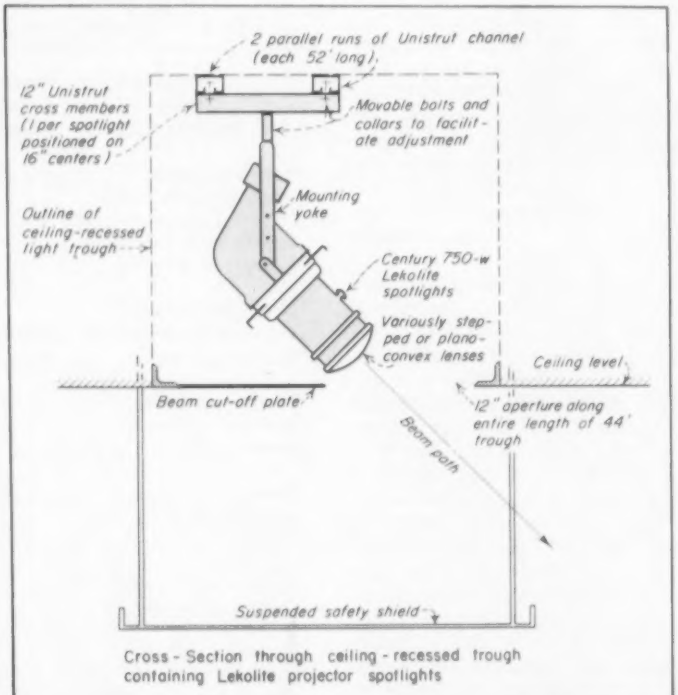
7-Segment Illumination Plan

To better visualize the actual lighting installation, it is helpful to discuss it by separate areas, for the system has numerous distinct features which are functionally related to (1) a centrally located dance floor, elevated to table height, which projects into the dining room from one wall and measures approximately 30-by-40 ft, (2) two curved stairways at one end of the dance floor that flank (3) an orchestra and M-C area, and which sweep upwards to (4) a second, higher stage. There are also several interesting lighting treatments designed to effectively illuminate (5) the large surrounding dining area, (6) an adjourning cocktail lounge and (7) the club's main entrance.

Discussing the installation approximately in that order, we first find that the elevated dance floor (where many of the larger production numbers are staged), is illuminated from three sides by 80 750-watt fully adjustable recessed Lekolite projectors. Of this total, 32 units are mounted in each of two 44-ft ceiling troughs that parallel either side of the floor, while the remaining 16 projectors are mounted along the outer parapet of a main lighting gallery which directly faces the stage, which projects downward from the ceiling for several feet, and which also contains the master C-lectochrome control console plus two powerful 3-kw and two 100-amp carbon-arc "follow" spotlights that may be swiveled manually so as to continuously highlight areas of primary visual interest.

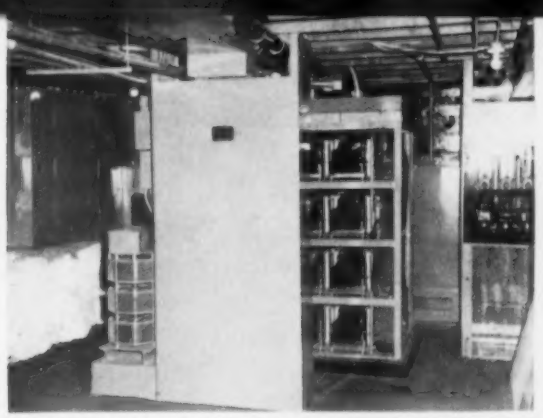
Unusual Lighting Flexibility

Lekolites are variously clear-lensed or are equipped with red, blue or green filters, three units of each color constituting a separate


2 parallel runs of Unistrut channel (each 52' long).
12" Unistrut cross members (1 per spotlight positioned on 16" centers)
Movable bolts and collars to facilitate adjustment
Mounting yoke
Outline of ceiling-recessed light trough
Century 750-w Lekolite spotlights
Variously stepped or plano-convex lenses
Ceiling level
Beam cut-off plate
12" aperture along entire length of 44' trough
Beam path
Suspended safety shield

Cross-Section through ceiling-recessed trough containing Lekolite projector spotlights

RECESSED SPOTLIGHTS flanking the dance floor are mounted on 2-way Unistrut supports and mounting yokes, permitting maximum flexibility of adjustment. Continuous aluminum cut-off plates and auxiliary suspended safety shields effectively mask lighting units from view of patrons. Individual spotlight spill-light trimmer frames and adjustable stepped or plano-convex lenses are additional aids in creating exact lighting patterns.



POWER CENTER for nightclub is basement-based; contains main breaker, 225-kva transformer, 15-section magnetic-amplifier dimmer assembly and all related switchgear. Installing electrical equipment in old building, where close physical tolerances and multi-elevation construction was prevalent, created numerous installation problems for electrical contractor.

COMPACTNESS of main C-lectochrome console places all control levers within convenient reach of operator. First stage show to be presented after completion of new lighting installation included interesting demonstration of console equipment by author, shown above at console. Lighting patterns may be varied at will manually, or preset.

group, and each group separately focussed, circuited, dimmer-controlled and switched to obtain maximum flexibility of regulation and control.

Lekolites flanking the dance floor area are mounted on 2-way Unistrut supports (an arrangement that provides wide latitudes for beam adjustment), and they are shielded from the view of patrons by continuous aluminum cut-off plates, auxiliary suspended safety shields located directly beneath the troughs, plus individual spill-light trimmer frames secured to each separate lighting unit. Undersides of cut-off plates and safety shields are ceiling-matched in color to minimize their presence.

In addition to these three banks of 750-watt Lekolites, the ceiling lines directly above side limits of the dance floor contain 18-unit rows of 200-watt louvered, recessed, inclined and adjustable floodlights which are used for "high acts"; that is, for presentations featuring trapeze, trampoline or high-wire performers.

With all fixtures thus shielded to preclude the annoyance of spill-light shining into the eyes of ringsiders; with multi-directional adjustment provided for all-angle shadowless illumination of acts, and with no structural columns or other obstructions located within the dining area, patrons sitting at any table in the house can enjoy the entertainment with complete visibility, definition and eye-comfort.

Acts and chorus numbers presented on the upper kidney-shaped stairway-flanked stage are illuminated by separate dimmer-regulated C-lectochrome-controlled 4-color circuits. Lighting is from both sides, top and bottom. For example, side-lighting consists of six vertical rows of borderlights (three located in each wing) that collectively include 24 300-watt and 48 150-watt PAR lamps; top-lighting (extending for 24 ft along the rear edge of the proscenium arch) includes 48 75-watt lamps, while floor-lighting (consisting of 14 thick-glass back-lighted luminous panels) includes another 56 lamps of the 100-watt size. All of these lamps are alternately red, blue, green and white; separately circuited by bank and color (24 circuits in all) to again provide countless color-blending possibilities.

Such possibilities are numerous, because an eye-appealing 10-girl "line" is backed by a curved cyclorama curtain, and is framed by a second vertically rising silver-glass festoon curtain that shimmers with multi-color reflections of harmonized color on the festooned folds.

Whenever the chorus moves from this upper stage level to the main dance floor, the girls descend the curved stairways through yet another area of color which is projected upwards and outwards through thick-glass sand-blasted stairway treads. This light, emanating from lumiline lamps in five different colors (three lamps per tread), is also dimmer-controlled.

Between the two stairways, in a back-draped alcove, an orchestra is lighted from both sides and from the floor by additional recessed 4-color striplight sections.

These many 4-colored lighting mediums provide unusual flexibility for creating variations in hue, saturation and brightness. And, for focusing attention upon orchestra leader, master of ceremonies, featured vocalist or similarly-stationary performer, four additional ceiling-recessed adjustable Lekolite projector spotlights may be aimed as desired. Lenses for these spotlights are clear, but they may be equipped with color filters whenever it is desired to create special 3-dimensional effects, illuminate a posed tableaux or to obtain a silhouette effect with the use of a scrim curtain.

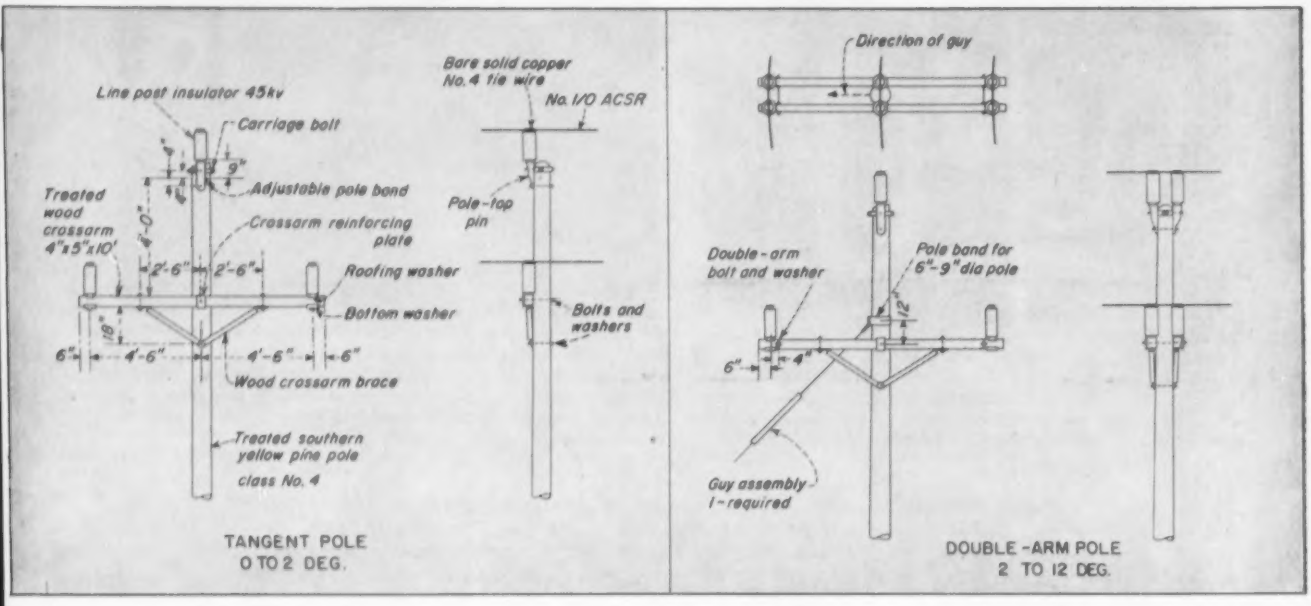
Soft Light for Dining

The general dining area also comes in for unique treatment, being initially illuminated by random-spaced star-shaped ceiling-recessed downlights, and lighted secondarily by periphery pinhole spots inclined to direct light upon outer walls.

Star-shaped downlights are equipped with 75-watt PAR 38 lamps, with interiors of enclosures painted variously in pastel rose, pink, peacock blue, yellow, amber and red. With this combination, white light passes through the star-shaped ceiling plates to illuminate tables below them, although, due to the interflection of light bouncing around within the colored enclosures, stars appear pastel-tinted when viewed directly at an angle. These lights are controlled by dimmers; thereby permitting bright light for business luncheon meetings or low lights of various intensities for party or show-time purposes.

Periphery pinhole spots are equipped with 400-watt lamps; they are inclined inwards at a 30-degree angle to throw light towards the walls, and they are ceiling-re-

(Continued on page 144)



From a typical job . . .

SPECS FOR A WOOD POLE LINE

A run-down on construction details of a three-mile wood pole line carrying a 34.5-kv aerial distribution system supplying widely separated outdoor substations.

By J. B. MacLean, J. B. Kelley and E. E. Turner

Electrical Engineers
Burns & Roe, Inc., Consulting Engineers
New York, N. Y.

CONSTRUCTION of a high-voltage distribution pole line is generally based on standard specifications for materials and methods. Of course, for any job, the actual spec details will vary with particular conditions. The conditions of terrain, directions of line sections, types of terminations and the type, size and electrical characteristics of the line conductors are important factors which determine scope and detail of the job specifications. The following paragraphs represent the major requirements of a set of specs prepared for a typical pole-line job. These specs give a clear, thorough account of typical pole-line design and construction.

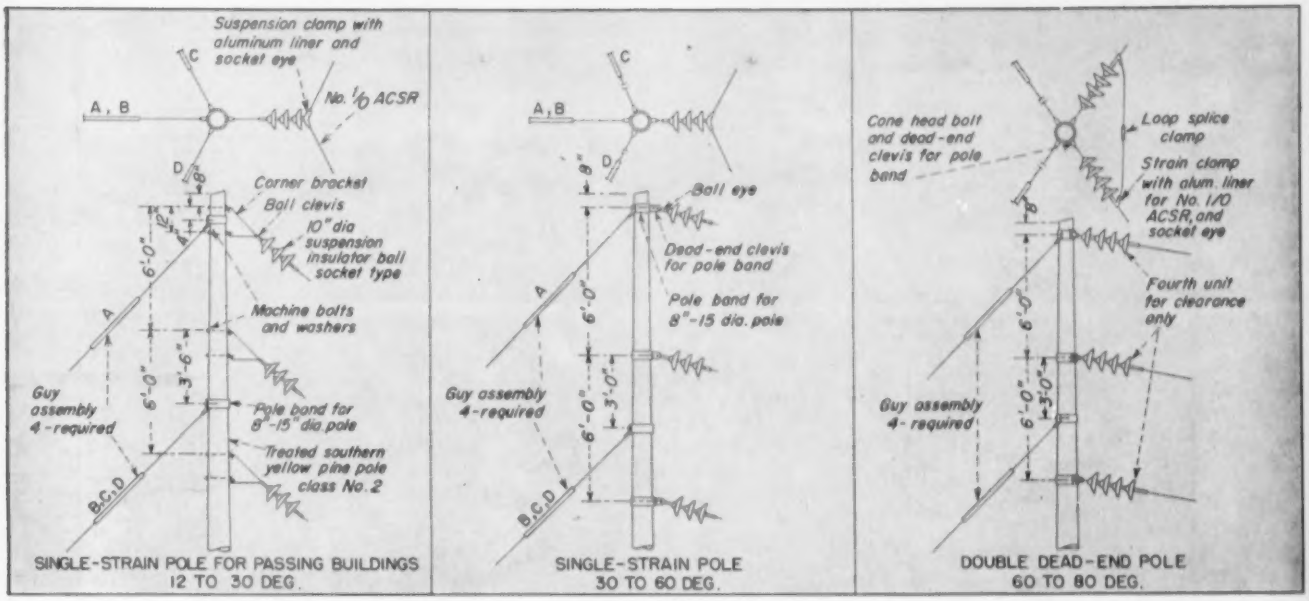
Preliminary sections of the specs set forth other specifications and standards which are incorporated as part of the job specs. For the case in study, various federal specifications were listed—covering connectors, bolts, hardware and wood preservatives—along with the National Electrical Safety Code, ASA standards on poles and conductors and NEMA standards on high voltage insulators and lightning arresters.

The "General" requirements for the job tied the contract drawings into the specs and permitted departures from the drawings only upon approval. Standard products were called for throughout the installation, and a material and equipment schedule had to be submitted within 30 days after award of the contract and prior to commencement of work. This schedule had to describe all of the material to be used.

Following the opening sections, detailed sections cover each piece of equipment and required installation techniques and methods. The substance of these sections is as follows:

Poles — Wood poles shall be either treated southern pine, treated Douglas fir, butt-treated western red cedar or butt-treated northern white cedar. Pine and Douglas-fir poles shall be full-treated from bottom to top. Cedar poles shall be butt treated from bottom to a point not less than 1 ft above the ground line.

Pole storage and handling—If poles are stored for more than two weeks, they shall be stacked on creosoted or decay-resisting skids which will support the poles without producing noticeable distortion in any of them. Poles shall be piled to permit free circulation of air through them, and the bottom poles in the pile shall be at least 1 ft


Suspension clamp with aluminum liner and socket eye
No. 1/0 ACSR
Corner bracket
Ball clevis
10" dia suspension insulator ball socket type
Machine bolts and washers
Pole band for 8"-15" dia pole
Treated southern yellow pine pole class No. 2
Guy assembly 4-required
A, B
C
D
8"
2'-0"
6'-0"
3'-6"
A
B, C, D
SINGLE-STRAIN POLE FOR PASSING BUILDINGS 12 TO 30 DEG.
Ball eye
Dead-end clevis for pole band
Pole band for 8"-15 dia. pole
3'-0"
SINGLE-STRAIN POLE 30 TO 60 DEG.
Cone head bolt and dead-end clevis for pole band
Loop splice clamp
Strain clamp with alum. liner for No. 1/0 ACSR, and socket eye
Fourth unit for clearance only
DOUBLE DEAD-END POLE 60 TO 80 DEG.

Minimum Depths for Pole Setting

Pole-Size: Length Over-All Feet	Straight Lines	Curves, Corners and Points of Extra Strain
	Setting depth, min. feet and inches	
40	6-0	6-6
45	6-6	7-0
50	7-0	7-6
55	7-6	8-0
60	8-0	8-6
70	9-0	9-6

above the general ground level or any vegetation growing there. No decayed or decaying wood shall be permitted to remain underneath stored poles. Pole tongs, cant hooks and other pointed tools capable of producing indentations of more than 1 in. in depth shall not be used in handling poles.

Pole setting — In normal firm ground, poles shall be set to minimum depths as shown in an accompanying table. So far as practicable, poles shall be set so as to maintain an even grade. When the average run is level, consecutive poles should not vary more than 5 ft in height. By carefully choosing the location of each pole so as to avoid the highest points and greatest depressions when passing over uneven ground, it may be possible to avoid the use of poles differing in length to any great extent.

If it is necessary to shorten a pole, this shall be done by sawing a piece off the top end. If this is done to pine or Douglas fir poles subsequent to treatment with preservative liquid, the end left bare shall be given a further application of preservative.

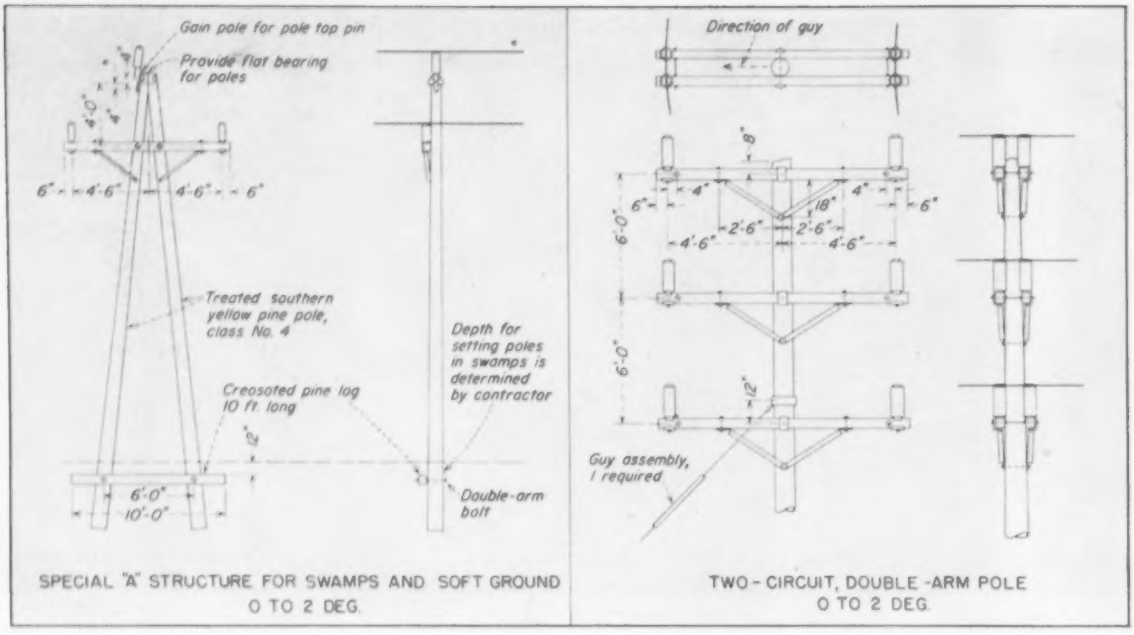
Where poles are set along the edge of cuts or embankments, or where the soil is liable to be washed out, special precautions shall be taken to ensure durable foundations, and the setting depth shall be measured from the lower side of the pole.

When setting poles, the holes shall be dug of ample size to allow easy entrance of the butts; and the size of the hole at the bottom shall be large enough to permit the use of tampers. When backfilling holes, a minimum of three tampers shall be used to each shoveler to assure tight packing of the earth. In no case shall the earth be thrown in to a greater depth than 6 in. without being tamped hard before the next layer is thrown in. The surplus earth shall be placed around the hole in a conical shape and packed tightly to drain water away from the pole.

Poles on straight runs shall be carefully aligned, with crossarms at right angles. Where the direction of line changes, the crossarms shall be set to bisect the angle thus formed in the line, if the angle of departure does not exceed 60 degrees. For angles greater than 60 degrees, dead-end assemblies shall be used. When practicable, crossarms, braces and other fixtures shall be mounted on poles before erection.

Crossarms and fittings—Crossarms shall be straight-grained, air-dried or kiln-dried, standard crossarm-grade Douglas-fir, or close-grained, treated southern pine. Crossarms shall be drilled for steel pins, through bolts, brace bolts, and double-arming bolts as applicable to the installation. Arm braces shall be 1¼-in. by ¼-in. steel of adequate length, bolted to the crossarm; and after the arm has been carefully aligned, the braces shall be secured to the pole by means of a ½-in. by 5-in. lag screw.

Single crossarms shall be placed on opposite sides of consecutive poles, except where other arrangements are necessary for slack span purposes. Such arms shall be installed wherever required for good construction. The cross-sectional dimensions of 2- and 4-pin crossarms shall be not less than 3 in.



by 4 in., and of 6- and 8-pin crossarms not less than 3¼ in. by 4¼ in. The vertical and longitudinal strength of crossarms, and the requirements for climbing space and pin spacing shall conform to the requirements of the National Bureau of Standards Handbook H-43.

Double crossarms shall be provided at each line crossing, at deadends, at corners where the angle of departure from a straight line exceeds 20 degrees, and elsewhere as required to provide adequate vertical and longitudinal strength.

Pins — Pins shall be one-piece forged-steel with lead thread and shall be designed to carry the full strength of a pin body to the top.

Insulators — Insulators for use on the primary distribution system shall be made of brown glaze wet process porcelain or glass. Insulators shall be radio-freed and, for use on the 34.5-kv system, shall have flashover valves as listed in the National Electrical Manufacturers' Standard 42-83.

Guys—Guys shall be installed where indicated on the drawings. Guys shall be attached as near as practicable to the center of the conductor load to be sustained. Guy wire shall be 7-strand extra-galvanized steel. The grade of wire shall be either high-strength or extra-high-strength, at the option of the contractor. Where guys are wrapped around poles, at least three guy hooks shall be installed for each attachment. Where guys are attached to anchor rods, eye bolts or eye nuts, they shall be protected by thimbles. Three-bolt guy clamps shall be installed at each guy terminal. Guy strain insulators shall be installed in all ungrounded guys which come within 8 ft of the ground. Insulators shall have a mechanical strength at least equal to that required for the guys in which they are installed. The dry flashover of these insulators shall be at least double the normal line voltage and the wet flashover shall be at least as high as the normal line voltage between conductors.

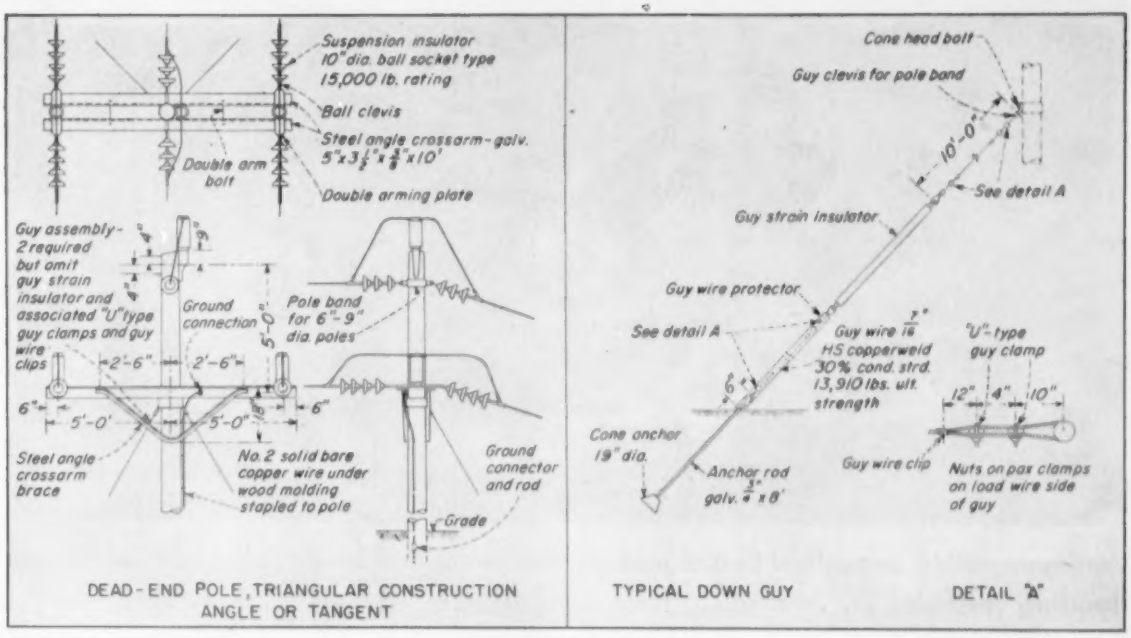
Guy anchors shall be of the expanding type (unless otherwise indicated on the drawings) except in marshy ground and rock. Rock anchors shall be installed approximately at right angles to the guy. The holding power transverse strength and longitudinal strength of guys shall conform to the requirements of the National Bureau of Standards Handbook H-43, for Grade B construction. The ground end of each guy attached to a ground anchor shall be equipped with a half-round, steel guy protector at least 8 ft long. The protector shall be securely clamped or bolted to the anchor rod or guy wire near the bottom and to the guy wire near the top.

Hardware—Pole line hardware shall be hot-galvanized. Suitable washers shall be installed under bolt heads and nuts on wood surfaces. Washers used on through bolts and double-arming bolts shall be approximately 2¼ in. sq and ⅛-in. thick. The diameter of holes in washers shall be the correct standard size for the bolt on which they are to be used. Double-arming bolts equipped with four nuts and four washers shall be installed for each double-arm installation. Eye bolts, bolt eyes, eye nuts, strain plates, and clevises shall be used wherever required to adequately support and protect the poles, crossarms, guy wires and insulators.

Conductors — Conductors shall be aluminum cable, steel reinforced No. 1/0 AWG. Conductors shall be constructed of six strands of 0.1327-in. diameter aluminum and one center strand of 0.1327-in. diameter steel. The conductor materials shall conform with ASTM specifications.

Conductor Installation — Care shall be taken in handling and stringing the conductors to guard against cuts, scratches or kinks. The conductors must not be drawn over rough or rocky ground in such a way as to be injured by rocks or stones.

The approximate route of the poles shall be as shown on the drawings accompanying these specifica-


Suspension insulator 10" dia. ball socket type 15,000 lb. rating
Ball clevis
Steel angle crossarm - galv. 5"x3½"x⅜"x10'
Double arm bolt
Double arming plate
Guy assembly - 2 required but omit guy strain insulator and associated "U" type guy clamps and guy wire clips
Ground connection
Pole band for 6"-9" dia. poles
2'-6"
2'-6"
6"
5'-0"
5'-0"
6"
Steel angle crossarm brace
No. 2 solid bare copper wire under wood molding stapled to pole
Ground connector and rod
Grade
DEAD-END POLE, TRIANGULAR CONSTRUCTION ANGLE OR TANGENT
Cone head bolt
Guy clevis for pole band
10'-0"
See detail A
Guy strain insulator
Guy wire protector
See detail A
Guy wire 7/16" HS copperweld 30% cond. strd. 13,910 lbs. ult. strength
6"
Cone anchor 19" dia.
Anchor rod galv. ¾" x 8'
TYPICAL DOWN GUY
"U" type guy clamp
12"
4"
10"
Guy wire clip
Nuts on pax clamps on load wire side of guy
DETAIL "A"

tions. The final exact route of the pole line and pole locations shall be determined by the contractor and presented in the form of drawings for route and pole location approval.

Conductors shall be strung in accordance with the cable manufacturer's published sag and tension charts. Sags and tensions shall be based on the cable tensions not to exceed 50% of the ultimate strength in a heavy loading area for Class B construction. Conductors shall be installed so that the final mid-span sag shall not be in excess of 1½% of the span, under maximum load conditions.

The contractor shall take whatever steps necessary to assure that the line clearances meet the requirements of the National Electrical Safety Code.

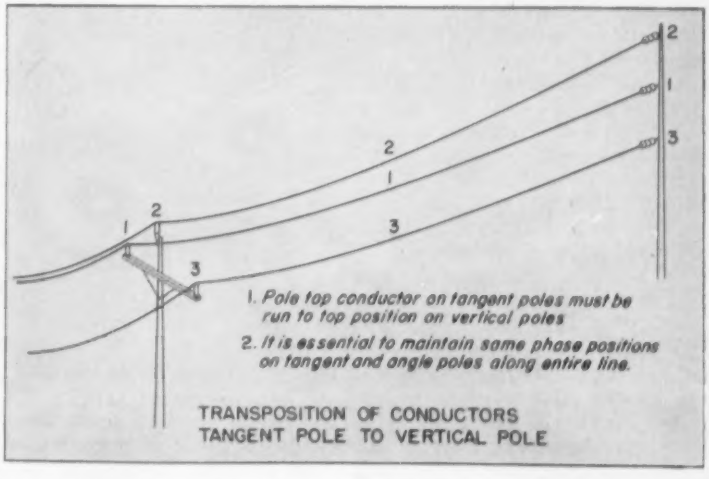
Right of Way — A minimum width of 30 ft of cleared right of way shall be provided where conditions permit. Where tree interference is present, trees shall be trimmed so that the line is at least 10 ft from nearest tree extremity.

A schedule of proposed tree removal and tree trimming shall be submitted for approval prior to start of clearing the right of way.

Lightning Arresters—Lightning arresters shall be equipped with suitable mounting brackets for the method of mounting shown on the drawing and shall be connected to a ground rod as specified on the drawings. The grounding conductor shall be soft weatherproof wire and shall be stapled to the pole at intervals not exceeding 3 ft. The ground conductor shall be protected by a half-round wood molding from the ground line to a point at least 8 ft above the ground line and throughout the space reserved for communication. The wood molding shall be stapled to the pole at intervals not exceeding 2 ft. Connections shall be made with solderless connectors.

The foregoing specification data clearly shows the wealth of engineering and careful construction which goes into pole-line work. The data presented represents an excellent basis for developing specification details on modern high-voltage wood pole transmission and distribution lines. Accompanying illustrations show typical pole-line assemblies for different conditions of use in the 34.5-kv line described in the specification data. In the diagrams of pole-top assemblies, the captions indicate the angles in the line at which the different constructions are used.

The construction described in these specifications was performed by B-B Electrical Contractors, Inc., Paterson, N. J. William B. Jayne was the superintendent.


1
2
3
1. Pole top conductor on tangent poles must be run to top position on vertical poles
2. It is essential to maintain same phase positions on tangent and angle poles along entire line.
TRANSPOSITION OF CONDUCTORS TANGENT POLE TO VERTICAL POLE

Luminous ceiling, acoustical baffles and air conditioning in Los Angeles' new Blue Cross building provides . . .

Model Environment for Office Workers

HOSPITAL Service of Southern California, handling Blue Cross hospitalization in its area, has itself invested in some excellent insurance. It has provided 125 footcandles of comfortable lighting, an excellent sytem of sound control, and climatic control through air conditioning, for its 275 employees who work in its new Los Angeles building. The resulting environment makes for an office workers' utopia, a clean, quiet, cool office with ideal seeing conditions, all factors which contribute to high worker morale, high efficiency, and better health for all.

The general office area of this new building is 96 ft wide by 189 ft long and has an 18-ft 6-in. high ceiling. This area is only one story high. At one end of this room is a two-story area housing private offices, and at the other end is a similar two-story area housing utilitarian work areas. Cafeteria and kitchen facilities are provided along one side of the building.

The 18,144-sq-ft general office area is lighted by a special Wakefield wall-to-wall luminous ceiling. This ceiling incorporates Plexiglas corrugated acrylic plastic diffusing panels, 12-in.-deep acoustical baffles instead of the usual 6-in. deep type, and large circular air diffuser outlets, plus the necessary wiring channels, lamps, housings, ballasts, support rods, etc. necessary to complete the installation.

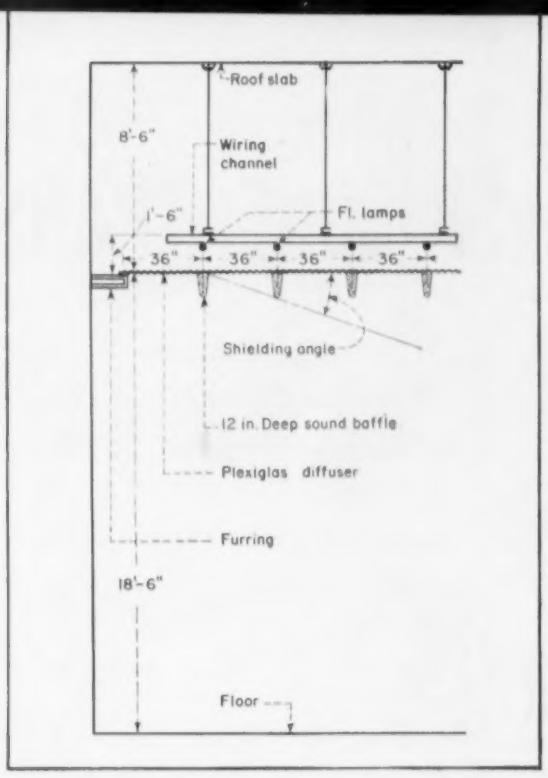
A total of 682 96T12 and 124 48T12 slimline lamps are installed above the plastic diffuser panels to provide the 125 footcandles of illumination. These lamps run normal to the length of the room, and are directly centered over the deep sound baffles.

The plastic diffusing panels are suspended 18 ft 6 in. above the floor, and 8 ft 6 in. below the roof slab. Top of the electric wiring channels is 18 in. above the diffusing panels (see detail).

Deep baffles were used for two reasons. First, it was desired to

GENERAL OFFICE AREA of 18,144 sq ft is lighted to intensity of 125 footcandles by wall-to-wall Wakefield luminous ceiling. Deep baffles absorb sound, also shield luminous plastic diffusers and eliminate glare.

DEEP BAFFLES are on 36-in. centers, adequately shield diffusers at an angle of 45 degrees and below.



LUMINOUS CEILING details showing location, and lamp and baffle arrangement with dimensions.

keep the noise level as low as possible in this large room with a higher-than-usual ceiling in which a large number of office machines are used. Second, deep baffles act as a shield for the plastic diffusing panels in normal viewing angles along the length of the room and eliminate direct glare.

Lamp channels were approved to carry 18 circuit wires to terminal blocks for connection to ballasts.

On the long south wall of the room both vertical and horizontal motor-operated shutters are used, which are controlled by a solar time switch. These shutters prevent glare from the sun and bright sky and reduce the air conditioning load considerably.

This lighting system and the electrical system was designed by Leo Press of the Foster Sampson Co., consulting engineers. Pacific Electrical & Mechanical Co., electrical contractors and licensed installers of Wakefield ceilings, installed the lighting system and performed the electrical work. Allison and Rible were the architects.

LAMP CHANNELS were used as a duct for lighting circuits, which were run to terminal blocks to which ballasts were connected. Rods support lamp housings to roof slab 7 ft above. Total lighting load is 68.6 kw for the combined lamp and ballast load, or 3.8 watts per sq ft. Lighting system provides 33 footcandles per watt per sq ft.

SILICONE TRANSFORMER REWIND

Step-by-step procedure in rewinding a 300-kva transformer using Class H insulation to give the unit increased service life and a boost to 400-kva capacity.

By **Earsil F. Stuart,** *Shop Manager, Interstate Electric Co., Tulsa, Okla.*

REWINDING large transformers is an everyday occurrence in many motor repair shops throughout the country. And silicone insulation is nothing new, either. But to the best of our knowledge, our shop is the first to put the two together.

We received the order for the transformer rewind when lightning struck a 13-kv line leading into the Research Laboratory of the Carter Oil Company in Tulsa, Okla. The strike flashed over the center phase of a ventilated dry-type, 300 kva, 3-phase, 13.8 kilovolts to 120/208 volts, wye transformer servicing lights and air conditioners.

Only a few days over a year old, the transformer was Class B insulated, with Class A fillers. Ordinarily it would simply have been rewound with equivalent insulation, but our preliminary inspection revealed that the unit had been operating far in excess of its rated temperature. Most of the over-heating was probably due to the fact that the transformer was located in a small basement room along with four boilers. Ambient temperatures reportedly often exceeded 125 F. As a result, the maplewood wedges inside the cores were actually charred black, and they had warped so badly that the windings were loose on their core legs.

To reinsulate the unit with Class B components would merely have postponed the inevitable failure for 12 or 18 months. Not only that, but just getting the transformer out and onto a truck would be an expensive chore in itself—not to mention the fact that the laboratories would have to shut down while it was being repaired. We therefore recommended that Carter approve Class H insulation for the transformer or get a bigger one. They decided on Class H, and we got underway.

Rewinding

Although we have rewound a good many Class A and B transformers, our only experience with silicone insulation consisted of rewinding a few motors. This experience however, plus the literature we obtained from Dow Corning Corporation on the subject, pointed the way toward what had to be done. Progress was as follows:

The three core tubes were fabricated by wrapping four layers of .030 silicone-impregnated asbestos paper around wooden forms. The low-voltage windings, 16 conductors, in parallel, of double glass served, silicone-impregnated No. 4 square copper, were wound directly on the coil tubes. The outer turns on each end of the coils were wrapped with two half-lapped layers of silicone-impregnated 5-mil glass tape.

High voltage barrier cylinders were wound as one complete unit with sheets of silicone-impregnated asbestos paper. For good mechanical strength, the core-coil separators were sections of plain asbestos-cement sheeting. Flash shields, like the core tubes, were silicone-asbestos, built up to ¼-in. thickness.

The 40 high-voltage coils on each phase were made up in pairs of 0.125 x .050-in. double-glass served, silicone-bonded magnet wire. Silicone-asbestos sheeting was used as layer insulation between pairs.

High-voltage coils were spaced out with separators of ¼-in. rigid silicone-glass laminate. These were bonded with silicone varnish and built up to as much as ½-in. thickness between coils where taps were brought out.

Four half-lapped layers of untreated glass tape were used for terminal and lead insulation. Untreated cloth was used because of its greater resiliency. It won't slip, tear or puncture as easily as impregnated glass cloth, and it conforms better to the shape of the bus and terminal connections. After final assembly, silicone varnish was brushed on the tape and baked.

Dipping and Baking

For handling convenience, each of the three phases was dipped and baked individually, up to the final cure. The entire job, incidentally, required only seven gallons of varnish.

Our dipping and baking schedule for each phase was as follows:

1. Pre-heat two hours at 325 F.
2. Remove and cool to 150 F. This took about two hours at room temperature.
3. Immerse in silicone varnish for 15 minutes. Because the transformer had no solid mass, but was almost a lattice-work of voids and air passages, it was not necessary to use vacuum impregnation.

4. Drain and air-dry for 45 minutes. This allows excess varnish to be released, and also removes much of the solvent in the varnish coating.

5. Bake for one hour at 300 F and one hour at 400 F. This drives out the rest of the solvent before the resin itself sets up too firmly. We felt that starting out with a high temperature would force the coating to cook in its own solvent, which in turn would cause bubbling —a condition which, on the high voltage coils, would certainly mean corona trouble.

6. Cool to room temperature; dip in silicone varnish for five minutes. With fans on the unit, it cooled in about three or four hours.

7. Drain and air-dry for one hour. Assemble the entire unit except, of course, for the case.

8. Bake one hour at 300 F and ten hours at 400 F.

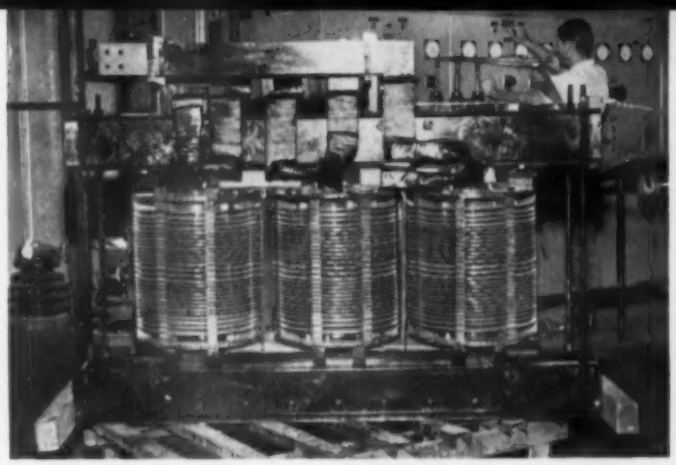
The end result was a good firm varnish setting. The coating was hard but not brittle, and there were absolutely no bubbles.

The finished transformer was given standard NEMA tests for high potential, megohms, high-low-ground, excitation core-loss and phase balance. These tests, incidentally, were conducted through a panel we built ourselves.

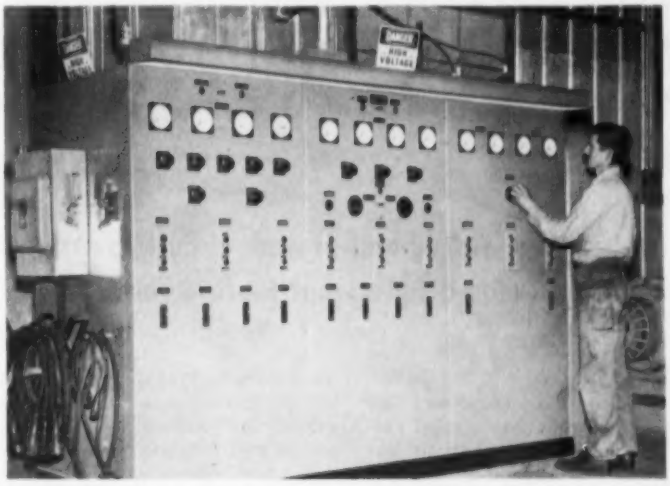
One other comment: the original transformer had no coil facings whatever at top or bottom. To improve its surge strength, we blocked the coils up with sections of silicone-glass laminate. Mechanical strength was notably improved, and surge strength increased over 25%.

Much of the credit for our success is due to our oven: a walk-in unit with a 600 F capacity and excellent air circulation. Of course, circulation is especially important. So much so that while our varnish baking schedule worked out fine for us, it might not work at all with a less efficient oven.

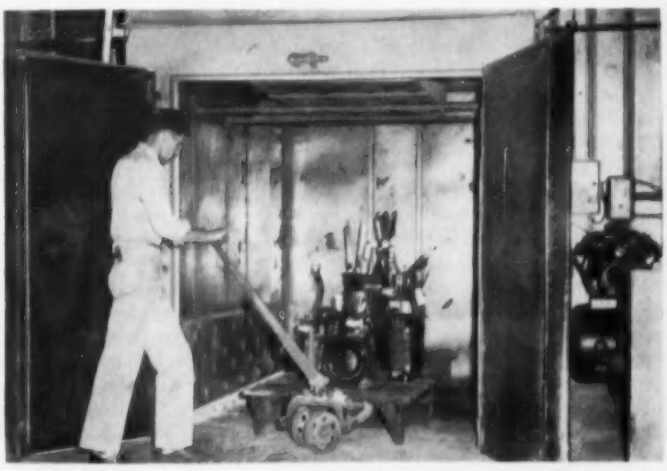
Our shop makes a profit on the job, and Carter Oil gained greatly increased service life (we estimate at least ten times that of its former life), much lower maintenance cost, and substantially increased capacity. We guaranteed the unit for a year with confidence and would also guarantee a 33⅓% increase in capacity. In other words, Carter Oil gave us a straight 300-kva unit. Using silicone varnishes and silicone-bonded components, we returned a high-temperature 400-kva unit.



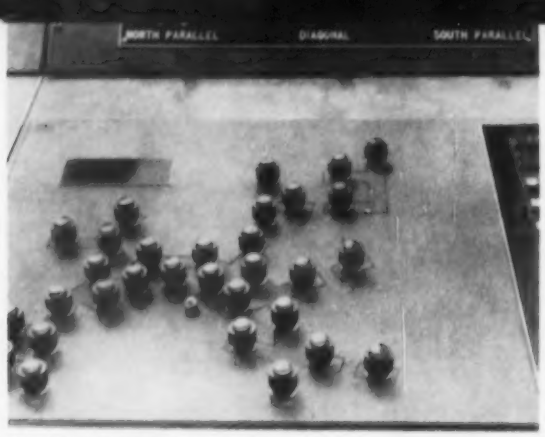
300-KVA TRANSFORMER was rewound with Class H silicone insulations used for coil tubes, high and low voltage coils, barrier cylinders, separators and tape on terminals and leads.



TEST PANEL used for rigorous checking of rebuilt transformer, according to NEMA standards, is a modern, completely safe enclosure with controls, meters, indicator lights and circuit protective devices—permitting wide ranges of tests at high and low voltage, ac or dc, with special provisions for transformer testing.



BAKE OVEN, an important factor in the successful rewinding of motors and transformers in Interstate Electric's shop, is a walk-in unit with a 600° F capacity and excellent air circulation, which add up to efficient operation.



CONTROL PANEL contains a miniature representation of the airport's system of taxiways, with translucent, back-lighted pushbuttons controlling relays for switching lighting on parts of taxiway corresponding to pushbutton locations.

EFFECTIVE CONTROL of plane taxi operations at night is readily maintained by operator in control tower who moves finger over pushbuttons along desired route of plane on facsimile layout of taxiway, operating corresponding lights.

Low-Voltage Relay Switching

for Airport Taxiway Lighting

A tested-and-proved circuit control technique which adds a functional feature to airport electrical design.

ECONOMY, ease of installation and versatility—these are the features which have spelled success for a low voltage relay switching system controlling taxiway lighting at Sky Harbor Air Port, Phoenix, Ariz.

"Phoenix Tower from Air Force 418. Ready to Taxi."

Automatically the tower operator brushes a finger across a series of pushbuttons on his control panel. Instantly one set of taxiway lights glows on the field.

"Air Force 418," comes the reply from the tower. "Just follow the lights."

At other airports the controller in the tower and the pilot of the plane would have had to keep up an almost steady conversation during the taxiing, otherwise a lead jeep would have had to be put into service to guide the plane to its assigned position. Not so with the "Path of Light" at Phoenix Sky Harbor Airport. There, night-time taxi operations are simplified and made safer by a development of the Touch-Plate Mfg. Corp. of Long Beach, Calif. This lighting system literally provides a "Path of Light" for pilots to follow while taxiing on a controlled airport. The pilot need not continually call the tower for special instructions, since the operator will indicate to him by the lights just which taxiway he is to follow.

At Sky Harbor, the cost of taxiway lighting was running as high as $120.00 a month. The 448-taxiway lights often were kept burning all night, and tower operators had to maintain almost steady radio contact with taxiing planes to keep them on the right taxiways.

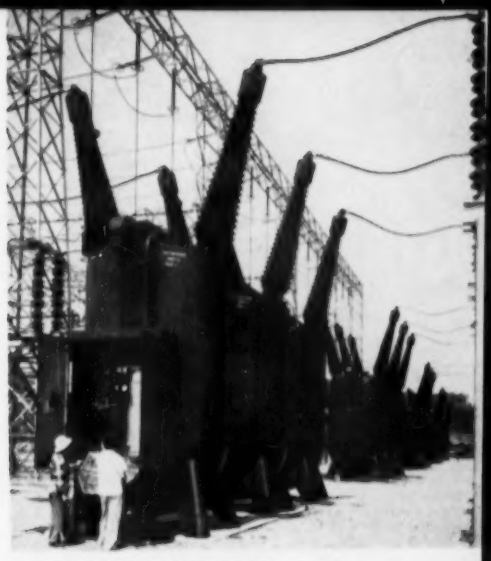
In a project engineered by Johannessen and Girand of Phoenix, the old high-voltage switching was replaced by the low-voltage relay system. Here is how it works:

A facsimile map of the Sky Harbor taxiways is mounted on a small panel on the tower control board. The entire panel is only 15 by 18 in. Pilot-lighted pushbuttons are installed over the runways on the map. These buttons, which require only the slightest touch, have transparent plastic tops and have tiny lights in them which indicate which taxiway lights are on. In directing a pilot to a taxi-route, the controller has only to brush his finger across the set of buttons representing the taxiway he wants the pilot to use. Without having to use the already busy radio circuit, the operator can indicate to the pilot the stop position for the plane and extinguish the lights behind, all with a light touch of the buttons.

This system has been "quite successful from an operating standpoint," reports J. R. Sindlinger, Jr., chief of the Civil Aeronautics Administration's Phoenix Combined Facility. "To our controllers, this system has meant easier and most positive control of our taxiing aircraft, since previously we were obliged to make frequent radio transmissions to help the pilots stay on the correct runways." And coupled with this new convenience is economy. Taxiway lighting bills at Sky Harbor have been reduced to as little as $4.40 a month with the new system.

In addition to the savings in electricity, the complete switching system is also economical to install. Using only components of standard Touch-Plate systems the Sky Harbor installation was designed and fabricated for less than $600.00.

MAINTENANCE OF PRIMARY CIRCUIT BREAKERS



MAINTENANCE INSPECTORS of substation circuit breakers should initiate prompt corrective action if breaker tank oil level or bushing oil gauge readings are low, if oil or air leaks are detected, if porcelain or cotter pins are broken or missing, if hardware or gasketed covers are loose, if air supply compressors are running excessively, if cabinet heaters are de-energized, if rust or corrosion is excessive, or if noise, smoke or temperature readings are out of the ordinary.

What is the purpose of a circuit breaker, and why is its maintenance so important? What should an inspector look for, and what corrective steps should be taken to prevent serious trouble? What items should be considered in planning a maintenance schedule, and how do you determine the interval between inspections? What safety precautions should be practiced, and are outdoor and indoor breakers maintained in the same manner? These and other pertinent maintenance questions are specifically answered in this practical fact-filled discussion.

By R. O. Bonine
Engineer, Circuit Breaker Engineering
Switchgear Division
Westinghouse Electric Corp.

THE PROTECTION of much equipment associated with the generation and transmission of power is highly dependent upon the proper design and operation of power circuit breakers, the functions of which are to:

1. Carry rated load current without overheating.
2. Open and close smoothly at the prescribed speed.
3. Interrupt overload and fault currents quickly.
4. Reclose very fast when required.
5. Withstand system voltage surges.
6. Help maintain system stability.
7. Simplify the routing of power over a complex transmission network.
8. Provide maximum continuity of service.

But a circuit breaker, like your car, must be kept in tip-top condition if the performance expected is to be obtained. A circuit breaker is given only one chance to trip each time lightning strikes the line, or when a large bird misjudges his distance, or when many other types of faults occur. If the breaker fails to trip, serious damage may result.

Circuit breaker failures may be prevented by frequent visual inspections, periodic external inspections, and regular scheduled complete maintenance inspections related to a preventive maintenance program having the following objectives:

1. Minimize downtime of production equipment due to circuit breaker failure.
2. Keeping the maintenance cost to a minimum.
3. Obtain maximum useful life from each breaker.

Inspection Procedures

During regular patrol trips through a switchyard or substation by an operator or maintenance man, he should observe any unusual conditions which may be an indication that maintenance is needed. While passing circuit breakers in the yard, any of these unusual conditions would serve as a warning that maintenance is needed:

1. Low bushing oil gauge reading.
2. Low breaker tank oil level.
3. Oil or air leaks.
4. Broken porcelain.
5. Loose hardware.
6. Broken or missing cotter pins.
7. Air supply compressor running excessively.
8. De-energized cabinet heaters.
9. Excessive corrosion or rust.

10. Loose gasketed covers.

11. Unusual noise, smoke or temperature.

It is a good practice to take a circuit breaker out of service periodically, possibly each six months, for an external inspection. A quick external inspection may be made without lowering any tanks or draining oil. The following checks should be made:

1. After the breaker has been properly cleared and tagged out of service, it should be power closed. Measure contact resistance with a "Ducter" or similar device calibrated in microhms. Measure the resistance between the top of condenser bushings on each pole unit. They should compare within plus or minus 10% of each other. This test will usually detect any faulty condition in the current-carrying parts, such as loose shunts, oxidized joints, badly pitted, burned, or broken contacts.

2. Measure contact compression or engagement with a timer rod inserted into top of lift rod on each pole and contact indicator such as ohmmeter, bell ringer, or lighting circuit. Measure from contact touch to fully closed and latched position. When such a low voltage contact indicating device is used, care should be used to guard against small particles of dirt causing false measurements.

3. Check lift rod and toggle stops to 1/16 clearance with breaker closed by hand closing device slowly to latch position without overtravel being applied.

4. Check breaker operation by closing and opening slowly with manual closing device, observing any unusual loading or friction.

5. Check operating mechanism as follows:

(a) Check all hardware for tightness.

(b) Replace any broken or missing cotter pins.

(c) Electrical connections should be clean and tight.

(d) Check all trigger and latch-engaging surfaces for proper engagement, spring tension, cleanliness and lubrication.

(e) Check auxiliary switch connections, contacts and operating linkage.

(f) Check control relay or contactor, connections, contacts, coils, insulation members, pins and bearings.

(g) Drain water from air reservoir, starting compressor, observing operation of compressor, valves, motor, air supply piping, belt tension and compressor crank case oil level.

(h) See that mechanism space heaters are energized and thermostat is in good operating condition.

6. Circuit Breaker Oil.

Oil samples should be taken and tested on all new equipment when installed, retested each six months on all breakers 23 kv and above. More frequent oil tests may be required on small breakers with low oil content, capacitor switching breakers or breakers on highly repetitive duty. The deterioration of oil in circuit breakers is caused by water, carbon, oxidation from excessive temperature, and contact with other foreign materials. Carbonization of oil in a circuit breaker is caused by arcing of contacts during breaker operations. Moisture may accumulate through condensation on the surface of the oil and on the inside from the entrance of moist air and by direct leakage through defective seals and gasketed covers. The dielectric strength of the oil for circuit breakers should be maintained to 22.5 kv or above at all times.

Scheduling Inspections

The planning of a maintenance schedule for complete maintenance inspections on power circuit breakers is very important. The ultimate objective is to obtain the most economical protection. The most commonly accepted practice is to make a thorough check of all adjustments and record settings during installation. Recheck again from six months to one year later. If any appreciable change is noted in the adjustments, another inspection should be made within six months to one year later. If the inspection indicates everything is being held in adjustment, the complete internal inspection would be scheduled once every two years. External inspections would, of course, be made more frequently. The following items should also be considered in planning the maintenance schedule:

1. Accumulated increments of kva interrupted.

2. Time since last inspection.

3. Number of operations, switching and testing.

4. Number, location and magnitude of faults.

5. Condition of oil.

6. Cleanliness of local atmosphere.

7. Vintage, age and type of breaker. Circuit breakers of earlier designs were less efficient than modern breakers. The interrupters used in older breakers required longer interrupting time, resulting in more mechanical wear, shock demonstration, and insulation deterioration. It has been good practice to inspect breakers in this class after each interruption.

8. Experience with specific breakers and duty imposed.

9. Preliminary inspection records.

10. Any unusual condition which may demand immediate attention, such as noise, temperature, smoke, oil or air leakage or friction.

A preventive maintenance program should be set up for the most economical operation. Use an itemized check list of all the items and adjustments to be checked, maintain record file on individual breakers consisting of instruction books, drawings, timing, test and adjustment records. After initial installation make maintenance inspections as follows:

Patrol inspection all breakers each week to one month. External inspection 69 kv and lower every four months. Complete inspection 69 kv and lower once a year. External inspection 115 kv and above every six months. Complete inspections 115 kv and above six months after installation, 18 months after installation, thereafter every two years.

The above recommended inspection frequency should be used as a guide only. A breaker subjected to a large number of operations, excessive interrupting duty or any unusual condition found on routine inspection should receive special consideration and therefore a decreased period between inspections.

Outdoor Breakers

1. Practice safety: obtain clearance, ground bushings, tag all circuits.

2. Close breaker by power before oil is drained or tanks are lowered in order to obtain contact compression check after power close.

3. This inspection should include thorough inspection of the following circuit breaker components:

(a) Operating mechanism.

(b) Condenser bushings.

(c) Insulation material, guides, lift rods etc.

(d) Stationary and moving contacts.

(e) Pole unit lever systems.

(f) Shock absorbers.
(g) Mechanical adjustments.
(h) Current transformers.
(i) Oil.

In maintaining operating solenoid and pneumatic mechanisms:

1. Clean thoroughly.
2. Relubricate all pins and bearings.
3. Check trigger and latch surfaces for oxidation, lubrication, engagement and spring tension.
4. Check all hardware for tightness, broken lock washers, broken or missing cotter pins.
5. Auxiliary switch operating levers, contacts, wiring connections and adjustments.
6. Relays, contactors, switches and fuses for clean, tight contacts, freedom of operation and proper operation.
7. Use SAE-30 engine oil to lubricate pins and bearings not dismantled.
8. Use recommended graphite lubricant on bearings, pins removed for cleaning, latches, triggers, valve parts, pistons, rings etc.
9. Use very light oil on piston shaft packing glands.
10. Check space heaters and thermostat.

When checking the air supply system:

1. Drain condensate from air storage tank.
2. Drain oil from compressor crank case, clean, refill with new SAE-20 oil for normal climates and SAE-20W for extreme cold areas.
3. Check operation of compressor, valves, belt tension, safety valves, pumping time; lubricate motor bearings if open sleeve-type are used.
4. Clean air filter.
5. Check operation of all pressure switches.
6. Check for leaks in air system and repair if necessary.

As to condenser bushings, clean thoroughly and make power factor test during installation and then again after one year's service, then every two years, except where test results have been obtained showing power factor values near the allowable limits specified in Bushing Manual 33-156 or appreciably higher values than those obtained on previous tests. Power factor test indoor bushings every three years.

Clean insulation materials thoroughly, check for cracked material, carbon deposits, loose rod ends, warped material, sign of moisture and condition of varnish.

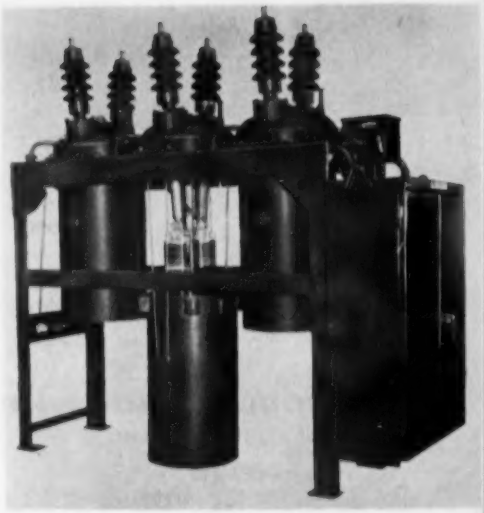
In maintaining circuit breaker contacts the stationary and moving contacts should be checked for proper alignment, compression, resistance, contact tip peening, cracking, deformation and excessive burning. If contacts are dressed by filing, remove projecting burrs only. Do not file to remove pitting. Check all pistons, rods and bearings for freedom of operation. Check all shunts and current-carrying joints for cleanliness and tightness. Clean carbon from grid stacks without dismantling. Check assembly tie rods for tightness and check that none are broken. Check fiber plates for excessive warpage. Be sure all adjustments are in order, properly tightened and securely locked.

As far as mechanical adjustments are concerned, check pole unit lever systems for proper travel, freedom of operation and satisfactory manual closing and opening. Check operation of hydraulic shock absorbers, lift rod and toggle stop settings. Unless stops are found to be loose or moved, it can be assumed that the lever system is in the proper position when closed to $\frac{1}{8}$-in. of stops. See that all cotters and hardware are in place and tight. Check and relubricate all bell crank and operating levers.

After the inspection has been completed and the breaker tanks filled with clean oil testing 25 kv or better, operate the breaker manually and electrically. Check tripping at reduced voltage and sneak trip test slowly by hand. Check mechanically trip-free mechanism for retrieving when released slowly by hand. Timing tests may be made but usually are not considered necessary unless adjustments are made or new parts installed. Thorough records should be kept including inspection reports, test results, travel records, drawings and manufacturer's instruction books.

Indoor Breakers

Indoor oil type power circuit breakers up to 15 kv and all current ratings require approximately the same maintenance as outdoor breakers with similar ratings. Usually the lower-voltage breakers require more frequent oil inspection and maintenance due to the smaller individual tanks and less oil volume. Circuit breakers in this class, up to 1200-amp ratings, employ current-carrying contacts of the finger and bayonet type engager for $1\frac{3}{4}$-in. The mechanical pole unit lever toggle and lift rod stops are adjusted for $\frac{1}{8}$-in. clearance. The high current circuit breakers 2000-amp and above usually employ laminated brush main current-carrying contacts and finger bayonet arcing contacts for transferring the arcing into a "De-ion" interrupter. The main current-carrying contacts should be adjusted for a minimum of 75% area contact and lever system stop clearance limited to $\frac{1}{32}$-in. maximum clearance. The condenser bushings are usually power factor tested every three years on the indoor oil breakers.



CIRCUIT BREAKER such as the unit above (Westinghouse type G) is easy to inspect and maintain because of its clean construction and accessible arrangement of components. Oil level, condition of contacts, etc., may be readily checked by dropping a tank, as indicated above.

The maintenance frequency depends upon atmospheric cleanliness and accumulated duty. In general, a preliminary visual inspection should be made every two to three months. A complete inspection should be made every nine to twelve months. This inspection should include removal of the arc chute for inspection and cleaning. A preliminary visual inspection should be made after each extremely heavy short circuit interruption.

1. Check structure to see that all hardware and cotters are in place and tight.

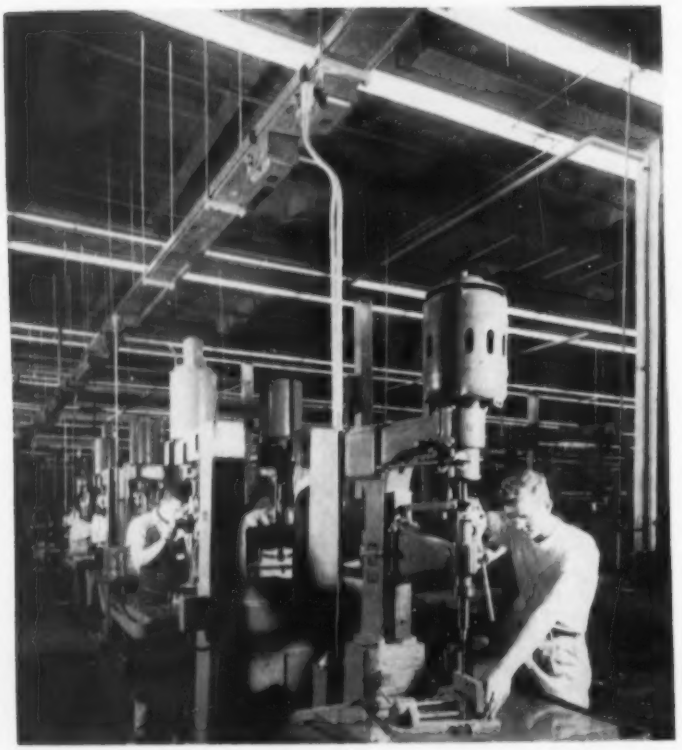
[Continued on page 146]

INVESTMENT IN DISTRIBUTION

Part Two*

Modern electrical equipment — for new construction, modernization or expansion — can:

1. Reduce risks of production shutdowns and damage,
2. Contribute to overall company profits,
3. Provide flexibility and capacity for change and growth, and
4. Protect equipment and employees from injury.



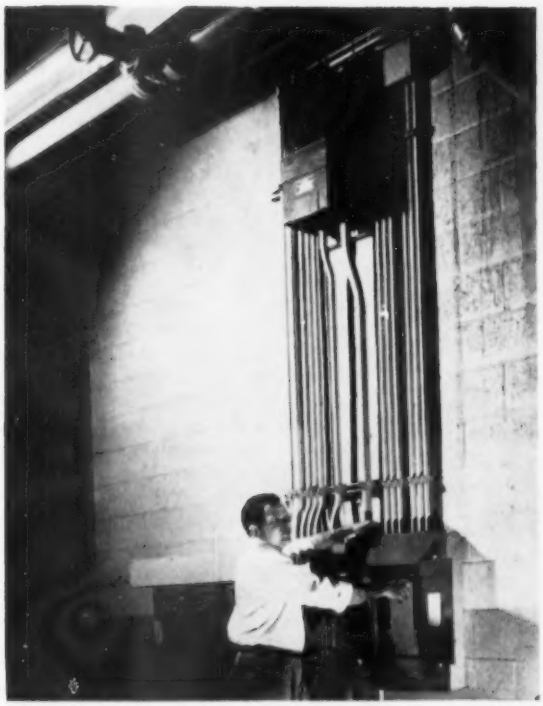
PLUG-IN BUSWAYS offer great opportunities for changes in machines layout, for machines may be relocated simply by unplugging switch units and plugging them in again at the new locations. Busways may also be lengthened or shortened, dismantled and reinstalled in different locations as load patterns change.

INDUSTRIAL power distribution systems can be considered as investment opportunities, provided that management properly evaluates the benefits which such equipment brings into being. These investment opportunities may be divided into four basic groups. Groups One and Two (those reducing risks of total or partial production shutdowns and equipment damage, and those predicting contributions to annual profits) were mentioned in detail in the first part of this 2-part discussion. Groups Three and Four (reducing future capital outlays and costs for system expansion and plant layout changes, and increasing employee safety) will now be considered.

III—Reduction of Future Costs

Managements that fail to authorize moderate extra investments in system design and equipment (to

*Second of a 2-part discussion designed to aid plant engineers, electrical contractors and consultants in determining power investments that will best serve specific conditions and purposes. Approaches are suggested for evaluating various returns which possible capital outlays for power distribution will yield.



DRY-TYPE TRANSFORMERS located close to the point of utilization can be easily relocated so that light and power requirements may be served from the same distribution system. This eliminates inflexible separate distribution systems and also provides an economical means for serving low voltage loads.

PLANNED EXPLOSION of an oil circuit breaker took place when a short-circuit current far beyond the breaker's interrupting capacity was applied. Explosions like this can happen whenever protective devices lack sufficient IC to interrupt available short-circuit current.

make power distribution systems expandable and flexible) frequently discover that their "economy" is short-sighted, because load growth and load shifts soon reveal bottlenecks that tend to make such systems partially obsolete. Then, subsequently breaking these bottlenecks, management finds that corrections are far more expensive than the added initial investment would have been.

Moreover, since managements are generally planning further ahead in all areas, informed projections of increased load densities are important. These forecasts provide an essential basis for determining what expandability and flexibility should be built into the power distribution system to provide for future changes. Examples of this type of foresight would include the selection of higher voltages and the use of expandable and flexible load-center systems. Management should also consider added investments for extra capacity service entrance switching equipment, primary feeders and the like.

a) *Investment for Adaptability*

The amount of capital which a management can prudently invest for the purpose of achieving future savings rather than present profits depends upon judgment which is based largely upon information concerning (1) the size and certainty of prospective savings, (2) the length of time before they will be realized, and (3) the additional annual depreciation and capital interest charges assignable to the extra equipment investment. Therefore, forecasts and comparisons such as the following are required.

Evidence that present load will grow, together with forecasts of the magnitude and timing of this expansion and estimates as to the extent of changes in equipment that this expansion will dictate.

Estimates of future reduction in capital outlays that can be achieved by providing the present system with the means for expansion.

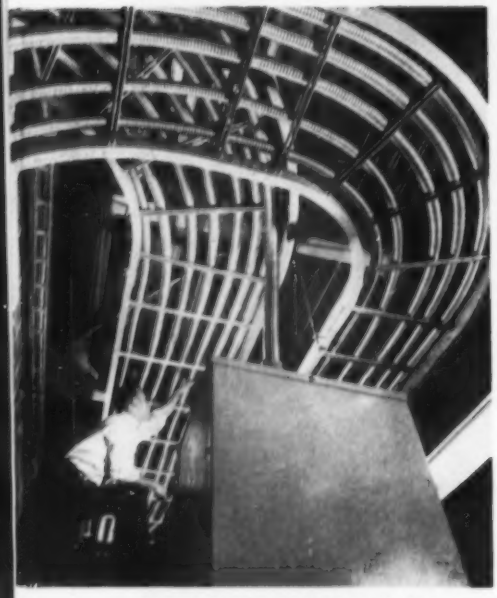
Estimates of future reduction in change-over costs, obtained due to built-in flexibility of present system. This would consider such things as the extra investment for plug-in busways, compared with secondary feeder cable.

b) *Forecasting Loads*

If your company is serving reasonably predictable markets, you can translate marketing goals into overall production plans which, in turn, will determine future increases in loads at specific plant locations.

Consumption of power may well increase faster than rate of production because kwh consumption, per unit of product, is generally increasing throughout most manufacturing industries. Production engineers can also furnish information concerning contemplated uses of power or further electrification which will lift total load more rapidly than total production. They may also be considering new machines or motors with higher horsepower, mechanized materials handling, process heating, electroplating and the like. All of these predictions, estimates and summaries could then be shown effectively on a load-growth chart.

The extent to which production equipment will be added, replaced or relocated will furnish an approximate indication of the need for flexibility. This need would also be influenced by plans for new products, new processes, product improvements and the generally accelerated rate of technological change in all of industry.



INTERLOCKED ARMORED CABLE, completely enclosed in metal, offers maximum safety and, in addition, the flexibility of this type of modern conductor makes possible almost 100% reuse if conductors are reformed for new locations.

c) *Optimum Investments*

Considerations that enter into decisions on optimum investments in system expandability should be governed by the following question: Which additional present investment in system expandability will reduce total system investment in the future by amounts sufficient to justify the total cost of tying up extra capital?

For example, suppose that a distribution system to meet present needs costs $270,000 and that load-growth predictions indicate that an additional $60,000 will have to be spent within the next year or so. As an alternative, an oversized and more flexible present system could be installed now for $290,000, then improved later for an additional $30,000. This would compare total costs of $330,000 and $320,000, indicating a $10,000 overall saving if the alternative decision was followed. In this simplified example, management would probably approve the extra $20,000 now to realize a reduction of $30,000 in a year or two. If the eventual contemplated saving were not to be realized for 5 or 10 years instead of one or two, however, management might choose to adopt a wait-and-see policy and install the less expensive system now. Time is an important element in such capital investment decisions, so forecasts of future load growth and expansions should be as accurate as possible.

d) *Investment Attractiveness*

Whether you are modernizing, expanding or considering new construction, there will be several possible investments in expandability which management should consider. These various investments should be analyzed one by one, beginning with those contributions which are beyond question because resultant savings would far outweigh the extra present investment. Added investments could then be presented in the order of their decreasing returns or attractiveness. Management can examine this array of possibilities and, on the basis of their equipment investment practices, select the "cut off" point beyond which they will not invest in future system expandability.

e) *Evaluating Extra Investments*

Added investments to obtain future flexibility can usually be justified only by the anticipation of major plant layout changeovers, although flexibility can be furthered in several instances by investments which are actually less than a less flexible system might involve. For example, flexible interlocked armored cable costs considerably less than cable in conduit, and flexible load-center system costs are less than a secondary distribution system. However, flexible plug-in busways do require a larger investment than the use of cable, although their use makes it easy to relocate machines or to disconnect and reconnect sections to meet changing loads and layouts.

f) *Longer Service Life*

The longer service life of high quality distribution equipment cuts future equipment replacement costs and thereby lowers your long-term distribution system investment. To be sure, much of this reduction in capital outlay may occur far in the future and, therefore, savings from this source might not justify extra present costs for better equipment. However, it is one very important factor to consider in relation to added investment.

It might also be noted that long service life of good distribution equipment will seldom be cut short by technological obsolescence as is the case with many machine tools, although significant equipment improvements and future innovations will undoubtedly come into being in the future.

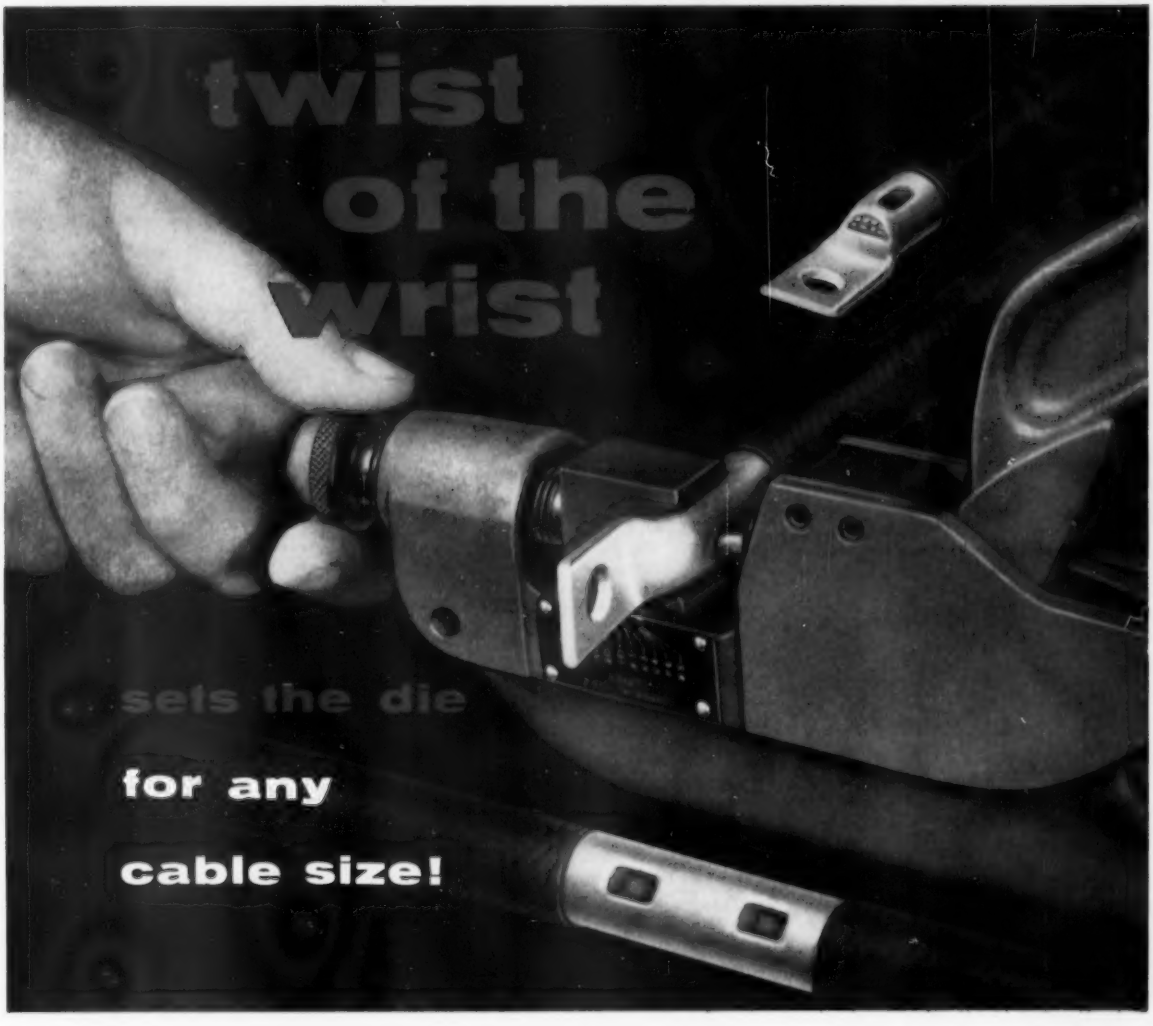
IV—Greater Employee Safety

Only a small fraction of the safety value of a modern power distribution system can be expressed in dollars, for safety is mainly a matter of human values involving the health, safety and well being of human beings. Hazards are admittedly costly in terms of lowered efficiency, productivity and morale, plus higher liability risks and insurance premiums. Avoidable hazards, however, are also inhuman, and managements are placing increasing emphasis upon employee safety. Management is naturally anxious to avoid unnecessary capital outlays for theoretical degrees of safety, yet it will want to authorize power distribution investments large enough to provide maximum protection for employees against electrical accidents that could cause painful injuries, disability or even death. Therefore the question of justifiable investments in safety enters such considerations as modernization or replacement of distribution equipment, particularly such items as protective devices. Many special circumstances have a bearing upon the kinds of information management finds pertinent to electrical safety. These include:

a) *How Real is Danger*

If the present distribution system has been causing accidents or near accidents, a brief presentation of these facts should probably be sufficient to underscore the need for correcting the hazardous conditions. If, on the other hand, there are hazards which have luckily given no trouble, you should advise management of that fact so that a false sense of security will not result.

Management may wonder why electrical accidents are not stressed more than they are, if the danger is real, so it should be pointed out that (1) such accidents do not attract automatic publicity, as do such catastrophies as floods and fires, (2) the individual companies in which these accidents occur are understandably reticent about discussing them, and (3) very few



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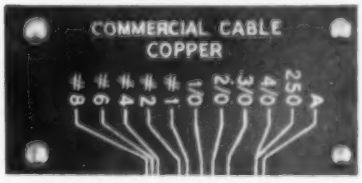

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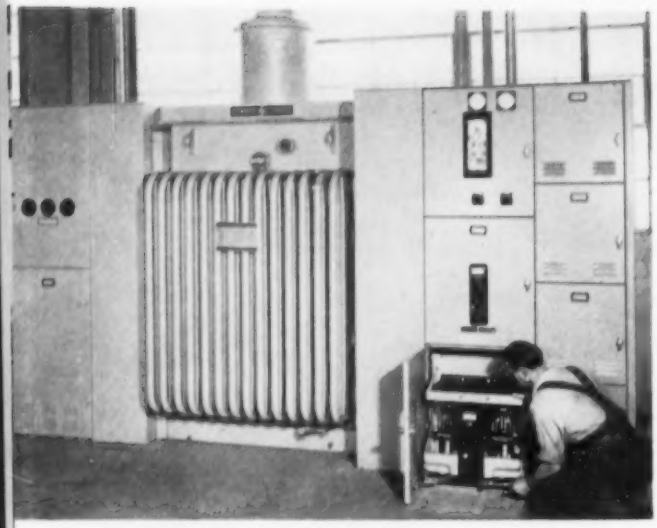
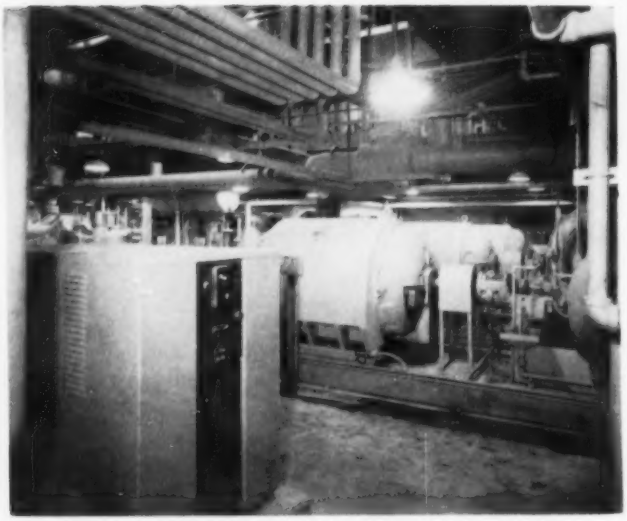


MODERN UNIT SUBSTATIONS are of metal-enclosed construction with drawout switchgear. Circuit breakers are automatically disconnected when cabinets are drawn out, permitting efficient and safe maintenance practices. Adequate interrupting capacity of switchgear is most important.



VOLTAGE-SENSITIVE EQUIPMENT on individual feeders can be served by a voltage-stabilizing transformer that keeps voltage variations within plus or minus 1%. Stepless variable voltage can be obtained by the use of an Inductrol unit, such as the one pictured above.

states, insurance companies or other organizations maintain complete records on industrial accidents of electrical origin. Electrical accidents are therefore not identified as such, or their electrical origins are not adequately reported. Lack of publicity and general knowledge, plus good luck in a company's personal experience, is no substitute for safety, however.

One of the few states maintaining records on industrial accidents is California. During a single recent year these records show that 755 industrial electrical accidents occurred in that state, with 640 of them (85%) occurring on low-voltage circuits. Reports on 345 of these low-voltage accidents further showed that 10 employees were killed, 205 persons received arc burns (82 of which were attributed to short circuits and 94 of which resulted from manually operated switches, fuses, or combinations thereof), 107 persons received shock injuries resulting from direct contact with energized conductors, and 23 persons received shock injury through energized enclosures which are normally neutral (such as equipment housings, machine frames, conduit or raceways). If these records can be considered as typical throughout the country, we may estimate that electrical accidents in industry injure about 15,000 employees each year and kill 200 more.

b) *Types of Accidents*

The main kinds of injuries related to electrical causes may be summarized as follows:

Shock from contact with exposed live parts or normally neutral enclosures and machine frames that have been energized by ground faults.

Burns from heat generated by short-circuits or from arcs produced by inadequate switches.

Wounds from pieces of metal that are sent flying when protective devices explode in the attempt to interrupt short-circuit currents beyond their ratings.

Burns and other injuries that may result *indirectly* from fires caused by inadequate or faulty electrical equipment.

Hazards of inadequate switching and protective equipment are often not understood or recognized, yet it should be remembered that a circuit device or other protective device with inadequate interrupting capacity is, in effect, a combination incendiary and fragmentation bomb that may be triggered at any time by a heavy short-circuit current pouring in from the supply system.

c) *System Protection*

The ways in which a power distribution system protects against electrical accidents may be classified under three fundamentals of safety.

Live parts are enclosed in grounded metal. This pertains to all distribution equipment, including switchgear, unit substations, panelboards and motor control centers; primary and secondary feeder conductors, such as busways and interlocked armor cable; and the frames of all motors, motor-driven machines and other electrical equipment.

Adequate interrupting capacity should be incorporated in all switching equipment, sufficient to interrupt the maximum short-circuit current which the supply system can deliver.

De-energize circuits before performing any maintenance or other work, doing this either by switching or automatically by interlocks.

d) *Safety Trends*

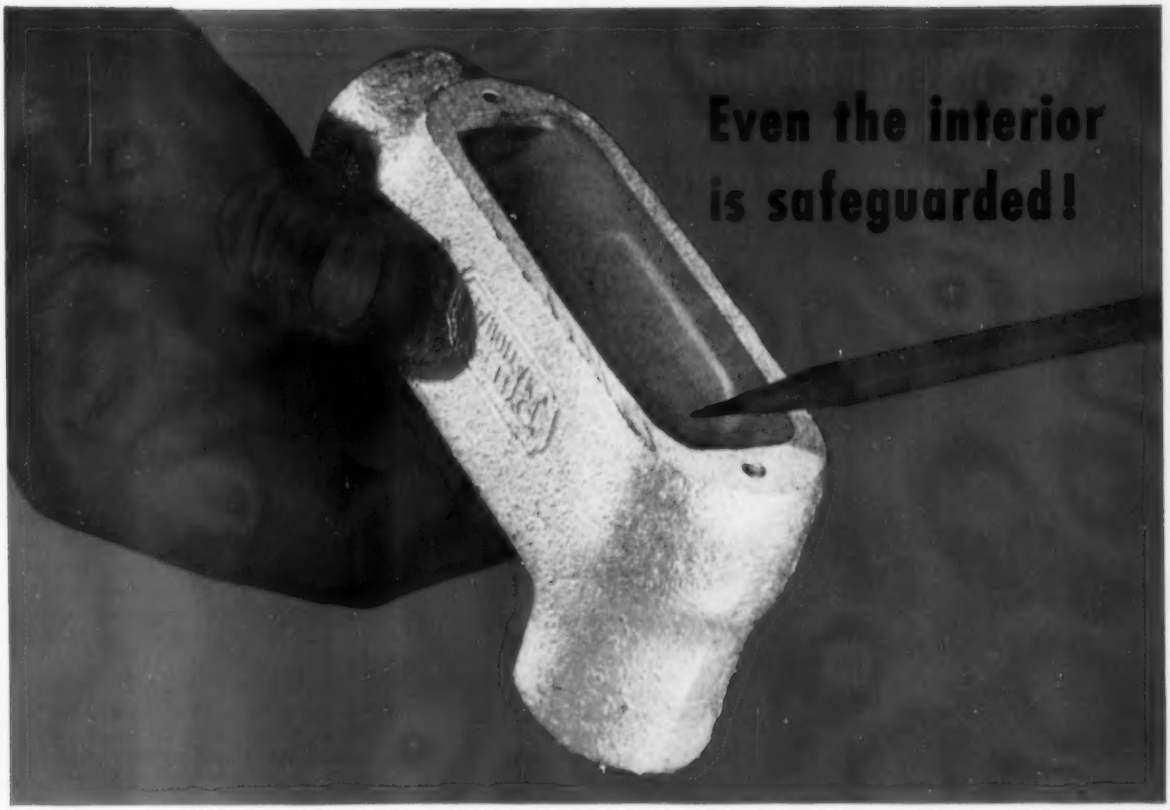
Since safety-obsolescence is important, it may be pertinent to review some trends that are raising accepted standards of employee safety. These include:

Safety campaigns that are increasing safety-consciousness.

Public opinion that is leading to new safety legislation, stricter administration and judicial interpretation of existing safety laws, codes and regulations.

Safety expectations of employees are being voiced by their representatives in labor-management discussions.

(Continued on page 122)



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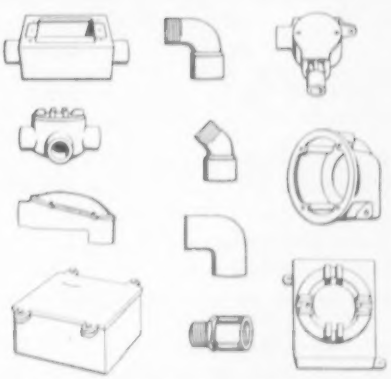

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Investment In Distribution

. . . Starts on page 116

Active local groups may exist within a particular branch of industry, community or plant, placing an unusually strong accent upon safety.

e) Investment in Safety

In general, safety is an added justification for investing in careful system design and the best available equipment. And, once a decision to modernize a system has been reached, safety continues to be a factor affecting the overall investment. This should be a system-wide consideration, for a high degree of safety only on the primary side does not make up for hazards in the secondary system (where most accidents do, in fact, occur).

In new and old systems alike, safety considerations enter investment decisions as an added justification for investing in careful design, approved equipment, proper engineering and coordination. When these factors are considered and applied, today's well-designed system provides a degree of safety which practically eliminates all electrical hazards during normal and emergency operation and during maintenance as well.

Factoring the Returns

The various returns on distribution investments cannot be added arithmetically because it is difficult or impossible to place a dollar value on many of them. Contributions to risk reduction, safety and reliability can't be converted into predictable increases in annual production and profits, yet distribution system investments may be strongly influenced by these arguments.

Then there are many investments that can be related directly to profit, such as capacitors (which will yield a return through power factor correction), voltage regulating equipment (where voltage is a critical process variable), or automatic switching equipment (to reduce peak demand). These opportunities that reduce costs, improve efficiency and contribute to annual profits are particularly applicable in old distribution systems and, in

(Continued on Page 124)

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Investment In Distribution

. . . Starts on page 116

many cases, these contributions are large enough to justify the complete modernization investment.

If the four groups of returns on distribution investment decisions cannot be added numerically, however, they can be put together or "blended" in a way that will help management evaluate their combined contribution to enterprise. This is so because:

High returns in the areas of risk reduction, employee safety and reduction of future capital outlays are related to extra investments for equipment of the best quality rather than "bare minimums".

Investments in risk reduction and employee safety alone justify the investment in grounding and protective systems, for it is not a sound investment policy to gamble with inadequate protection and possible danger.

Expandability and long-range flexibility should be evaluated and justified in terms of future reductions in net capital outlays and reductions in the cost of future production-line change-overs.

Whether or not annual profits can be related directly with total investment in careful system design and long-range planning, arguments can still be presented in terms of improved risk and safety values, reduction of present and future capital outlays, desirable performance characteristics, expandability and flexibility. In a new system, these values leave little to be justified by direct contributions to annual profits, although, in a modernization proposal, annual profits should be considered more critically as an investment factor.

These several approaches for evaluating returns which capital outlays for power distribution may yield briefly summarize General Electric's instructive booklet titled "Power to Produce".

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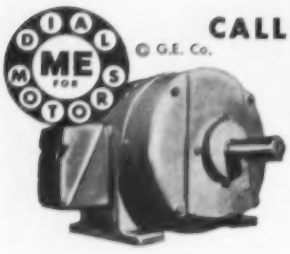

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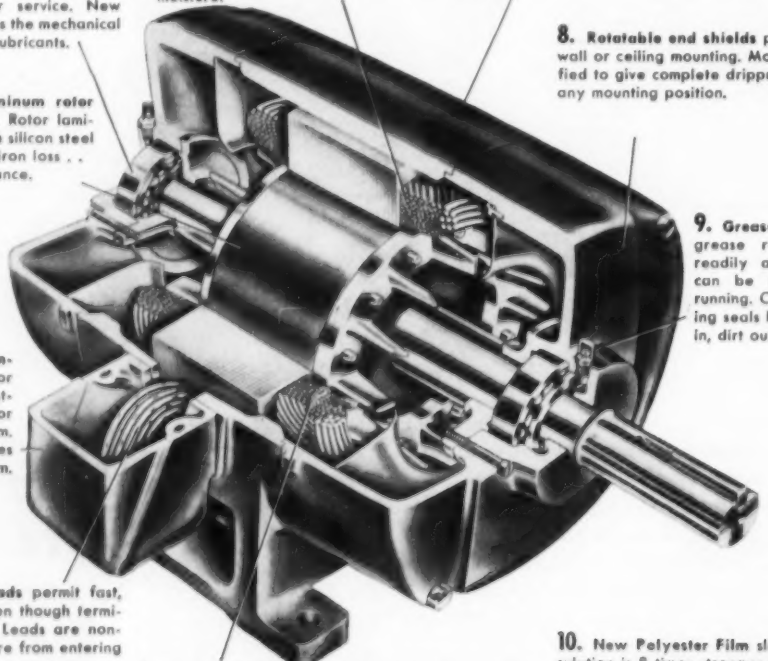

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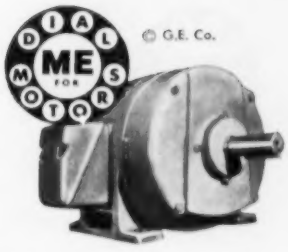

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MISSISSIPPI
JACKSON
Power Elec. Co., 5-8361

MISSOURI
JOPLIN
General Elec. Supply Co., MA 4-5622
KANSAS CITY
Graybar Elec. Co., BA 1-1644
Independent Elec. Machinery Co., GR 1-2610
ST. LOUIS
General Elec. Supply Co., JE 1-3000
Graybar Elec. Co., JE 1-4700

MONTANA
BILLINGS
General Elec. Supply Co., 9-4559

NEBRASKA
OMAHA
General Elec. Supply Co., JA 0456
Graybar Elec. Co., WE 7676
Schneider Elec. & Equip. Co., WE 5550

NEVADA
RENO
Linnecke Elec. Sales Co., 3-3729

NEW HAMPSHIRE
MANCHESTER
General Elec. Supply Co., NA 5-5418

NEW JERSEY
CAMDEN
National Elec. Supply Co., EM 5-4330
NEWARK
General Electrical Equip. Co., BI 2-2305
General Elec. Supply Co., BI 2-1600
Graybar Elec. Co., MA 2-5100
NEW BRUNSWICK
A. Bishop Elec. Motor Exchange, KI 5-6446
PATERSON
General Electric Supply Co., LA 5-5100
Reliable Elec. Motor Repair Co., AR 4-7756
Watson-Flagg Sales Corp., LA 5-2324
TRENTON
General Elec. Supply Co., OW 5-3453
Thropp Elec. Sales Corp., JU 7-1441
WOODBURY
Industrial Pump and Supply Co., TI 5-7030

NEW MEXICO
ALBUQUERQUE
Electric Service Inc., 2-9447
General Elec. Supply Co., 2-5246

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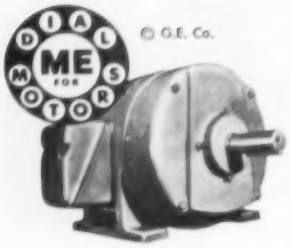
Graybar Elec. Co., 5-1563
Havens Elec. Co., Inc., 4-1201
BROOKLYN
Apparatus Distributor, Inc., UL 2-4000
BUFFALO
General Elec. Supply Co., EL 5100
Graybar Elec. Co., WA 3700
ELMIRA
LeValley McLeod, Inc., 6163
GLENS FALLS
Glens Falls Elec. Supply Co., Inc., 2-5868
JAMAICA
Central Queens Elec. Supply Corp., RE 9-2020
LONG ISLAND CITY
Graybar Elec. Co., EX 2-2000
Motors & Armatures Inc., EX 2-3523
NEW YORK
Electric Motors Corp., CA 6-4665
General Elec. Supply Co., AL 5-3300
Hudson Elect. Sales Co., Inc., WO 2-3041
W. W. Grainger, Inc., CA 6-3810
POUGHKEEPSIE
Electra Supply Co., Inc., GL 2-9000
ROCHESTER
Electric Equip. Co., Div. Norry Elec. Co., GL 3-6070
General Elec. Supply Co., GR 3-5200
T. H. Green Elec. Co., HA 6-9840
SYRACUSE
M. H. Salmon Elec. Co., Inc., 73-3325
TROY
Tri-State Elec. Motors, Inc., AS 2-4250
UTICA
Langdon & Hughes Elec. Co., Inc., 4-3154
Mather, Evans & Diehl Co., Inc., 4-6165

NORTH CAROLINA
ASHEVILLE
General Elec. Supply Co., 2-4481
CHARLOTTE
Armature Winding Co., ED 3-2158
General Elec. Supply Co., FR 5-5761

More G-E Distributors on next page . . .

GENERAL ELECTRIC



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OFF-THE-SHELF DELIVERY OF G-E TRI-CLAD MOTORS

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GREENSBORO
General Elec. Supply Co., 3-8207
GREENVILLE
General Elec. Supply Co., 5104
LAURINBURG
Electrical Equipment Co., 1196
RALEIGH
Electrical Equipment Co., TE 2-2039
General Elec. Supply Co., TE 3-4691

OHIO

AKRON
General Elec. Supply Co., FR 6-8195
Graybar Elec. Co., JE 5-4143
CANTON
General Elec. Supply Co., GL 4-5187
Jackson Bayley Elec. Co., GL 5-9421
CINCINNATI
General Elec. Supply Co., EL 1-2810
Graybar Elec. Co., MA 1-0600
CLEVELAND
Elliott Elec. Co., TO 1-2454
General Elec. Supply Co., HE 1-7280
Graybar Elec. Co., Inc., HE 2-2500
Strong, Carlisle & Hammond Co., TO 1-8800
COLUMBUS
General Elec. Supply Co., AX 9-1161
Graybar Elec. Co., CA 8-3811
Loeb Electric Co., AX 9-1142
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General Elec. Supply Co., MI 0781
Graybar Elec. Co., MI 5665
HAMILTON
Wente Elec. Co., TW 4-8128
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Genera Elec. Supply Co., EL 3-3196
TOLEDO
General Elec. Supply Co., Cherry 4-8661
Graybar Electric Co., EX 1641
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Economy Elec., Riverside 4-4461
General Elec. Supply Co., Riverside 6-6511
Graybar Elec. Co., Riverside 4-0124

OKLAHOMA

TULSA
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Graybar Elec. Co., MA 6-2121

OREGON

COOS BAY
Marshfield Elec. Co., Congress 7-6319
EUGENE
American Steel & Supply Co., 5-0373
MEDFORD
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Eoff Elec. Co., CA 2-9411
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Holt & O'Donnell, CA 8-0753
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Bovaird and Co., 7141
DREXEL HILL
General Elec. Supply Co., CL 9-6440
ERIE
General Elec. Supply Co., 2-1477
INDIANA
National Mines Serv. Co., 5-5655
JOHNSTOWN
General Elec. Supply Co., 7-5101
PHILADELPHIA
A. J. Lacourse, MA 7-1895
Electrical Repairs and Sale of Machinery, WA 2-2241
Jos. T. Fawkes & Co., WA 2-2241
General Elec. Supply Co., GA 6-8800
Graybar Elec. Co., WA 2-3405
PITTSBURGH
General Elec. Supply Co., FA 2-1530
Graybar Elec. Co., Inc., FA 2-4100
READING
General Elec. Supply Co., 5-8424
SCRANTON
General Elec. Supply Co., DI 4-8562
WESTCHESTER
Westchester Elec. Supply Co., OW 6-4722
WILKES-BARRE
General Elec. Supply Co., VA 2-5106

RHODE ISLAND

PAWTUCKET
New England Elec. Supply Co., 5-7400
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General Elec. Supply Co., GA 1-6523
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ANDERSON
Woodward-Stephens Co., Inc., CA 5-2501
GREENVILLE
J. W. Vaughan Co., 2-2421
SUMTER
Sumter Machinery Co., SP 3-7321

SOUTH DAKOTA

ABERDEEN
McLaughlin Elec. Supply House, 4911
RAPID CITY
Crescent Elec. Supply Co., FI 2-7913

TENNESSEE

CHATTANOOGA
Electric Motor Sales & Supply Co., MA 9-7361
Graybar Elec. Co., 4-3351
COLUMBIA
Middle Tenn. Armature Wks., EV 8-3672
MEMPHIS
Graybar Elec. Co., BR 8-7150
Tri-State Armature & Elec. Wks., JA 7-8414
NASHVILLE
Industrial Sales Co., Inc., AL 4-3508
Nashville Armature Wks., AL 6-2546

TEXAS

ABILENE
Graybar Elec. Co., OR 2-2861
AMARILLO
General Elec. Supply Co., DR 6-7255
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AUSTIN
Graybar Elec. Co., Greenwood 8-5674
BEAUMONT
General Elec. Supply Co., TE 3-6435
CORPUS CHRISTI
Bradley Motor and Armature Works, TU 2-8891
General Elec. Supply Co., TU 2-9237
DALLAS
General Elec. Supply Co., RI 2-2201
W. M. Smith Elec. Co., HA 8-4606
EL PASO
General Elec. Supply Co., 3-3407
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FORT WORTH
General Elec. Supply Co., ED 2-5385
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HOUSTON
Buffalo Elec. Co., CA 8-4431
General Elec. Supply Co., FA 3-3121
Graybar Elec. Co., CA 8-4571
Oliver Armature Works, CA 2-9271
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I. W. Hynd Co., MU 4-5501
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San Antonio Machine and Supply Co., CA 5-1651
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TYLER
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Electric Machine & Supply, HI 3-7604
WACO
General Elec. Supply Co., 2-1611
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Electric Motor Co. Div., United Elec. Co., 7-8333

UTAH

SALT LAKE CITY
General Elec. Supply Co., EM 3-3911
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Refrigeration Distributors Corp., DA 2-5886

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NORFOLK
General Elec. Supply Co., MA 2-7183
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General Elec. Supply Co., 3-1564
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Electrical Equip. Co., 7-2647
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Bluefield Supply Co., DA 5-6131
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Virginian Elec. Inc., 6-0631
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Logan Hardware & Supply Co., 710
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General Elec. Supply Co., RE 4-7155
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Snapp Elec. Co., 2-1031

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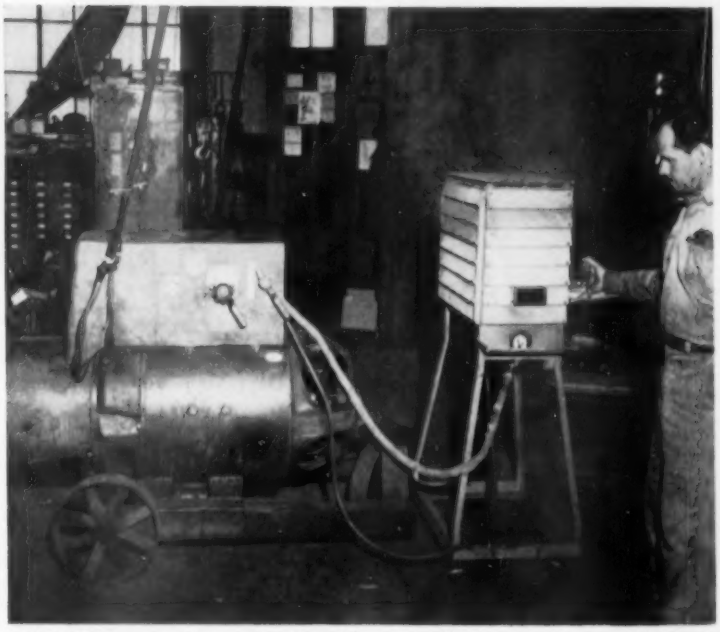
For more information on the new, fast-service plan—and "special" G-E Tri-Clad motors—call your local G-E motor Distributor.

SMALL A-C MOTOR AND GENERATOR DEPARTMENT

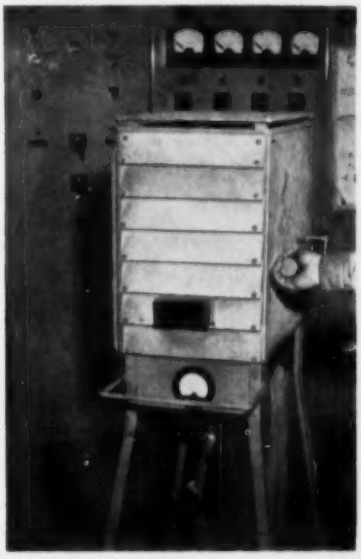
GENERAL ELECTRIC COMPANY, SCHENECTADY 5, N. Y.

GENERAL ELECTRIC

Motor Shops



LOAD TEST on a 600-amp electric welder at the Koontz-Wagner shop. Mechanic uses carbon-arc unit (right) to apply test load while watching commutator for evidence of sparking.



ASBESTOS ENCLOSURE, with louvered sides and perforated top, houses carbon-arc assembly. Lever at right is used to strike and break arc and adjust electrode separation. Mechanic looks through colored glass window in front; reads load on meter below.

Arc Test for Electric Welders

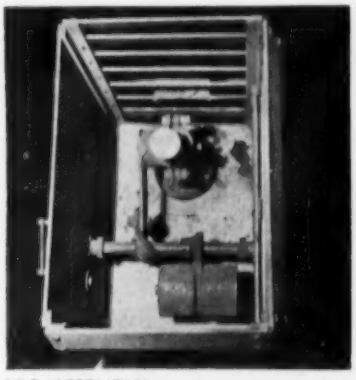
Electric welders are given a thorough load test before they leave the motor repair department of Koontz-Wagner Electric Co., South Bend, Ind. In fact, they are put through a much more rigid pace than actual field operation would impose. During tests, particular attention is directed to commutation—specifically, arcing at the commutator under load conditions.

Various methods of applying load—even the use of welding rods—were tried in the past. Under the rugged test procedure regular welding rod was melted down at a pretty fast rate and became a rather important cost item. To overcome this problem—and still maintain the arc type load—K-W engineers designed a portable arc-test unit employing a heavy carbon rod as one electrode and a metal block (piece of shafting) as the other electrode.

The arc assembly is housed in a rectangular asbestos enclosure 18 in. high, 19 in. long and 12½ in. wide. One side of the enclosure, accommodating the operating lever, consists of a ¼-in.-thick sheet of asbestos. The other three sides are composed of seven rows of parallel, asbestos-sheet louvers tilted about 25 degrees to the vertical. These louvered sides, plus a perforated asbestos removable cover, provide ample ventilation for the hot arc while testing is in progress. The housing is supported some 35 in. above floor level by a portable pedestal made of four 1-in. angle-iron legs welded to an 18-in. by 24-in. base of 2-in. angle-iron. The complete unit rolls on four casters and can be moved anywhere in the shop.

The carbon-arc mechanism inside the enclosure consists of a counterweighted horizontal shaft with a perpendicular arm supporting a length of 2½-in. diameter carbon rod. In the "down" position, the carbon rod is centered over a 2½-in.-high section of 5-in. diameter metal shafting which forms the second electrode. Both electrodes are connected to terminal-mounted test leads.

An exterior worm-gear attachment on the horizontal arc-assembly shaft simplifies arc adjustment during the test. The "worm" lever serves a dual operating purpose.



ARC ASSEMBLY inside enclosure. Arm supports carbon rod (top) over metal disc electrode (asbestos ring removed). Counter-weighted shaft (bottom) is attached to exterior worm gear and operating lever.

Lowering the lever makes contact between the carbon rod and metal disc. Once an arc is struck, separation between the two electrodes can be maintained at a predetermined distance by turning the worm-lever left or right. This actuates the worm-gear which rotates the shaft and raises or lowers the carbon rod. Test mechanics watch the arc through a colored glass window

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free.
THE RIDGE TOOL CO.
ELYRIA, O.
RIGID HEAVY DUTY 14
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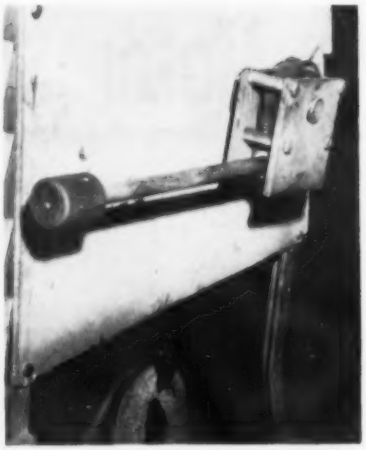
there's Only one



WORM GEAR adjustment on horizontal shaft permits test mechanic to maintain arc distance by rotating worm lever. Small rotation raises or lowers carbon rod fractions of an inch.

while rotating the lever to establish desired electrode separation. To break the arc, the mechanic merely raises the lever (without rotating it) to a point where the distance between electrodes is sufficient to choke out the arc.

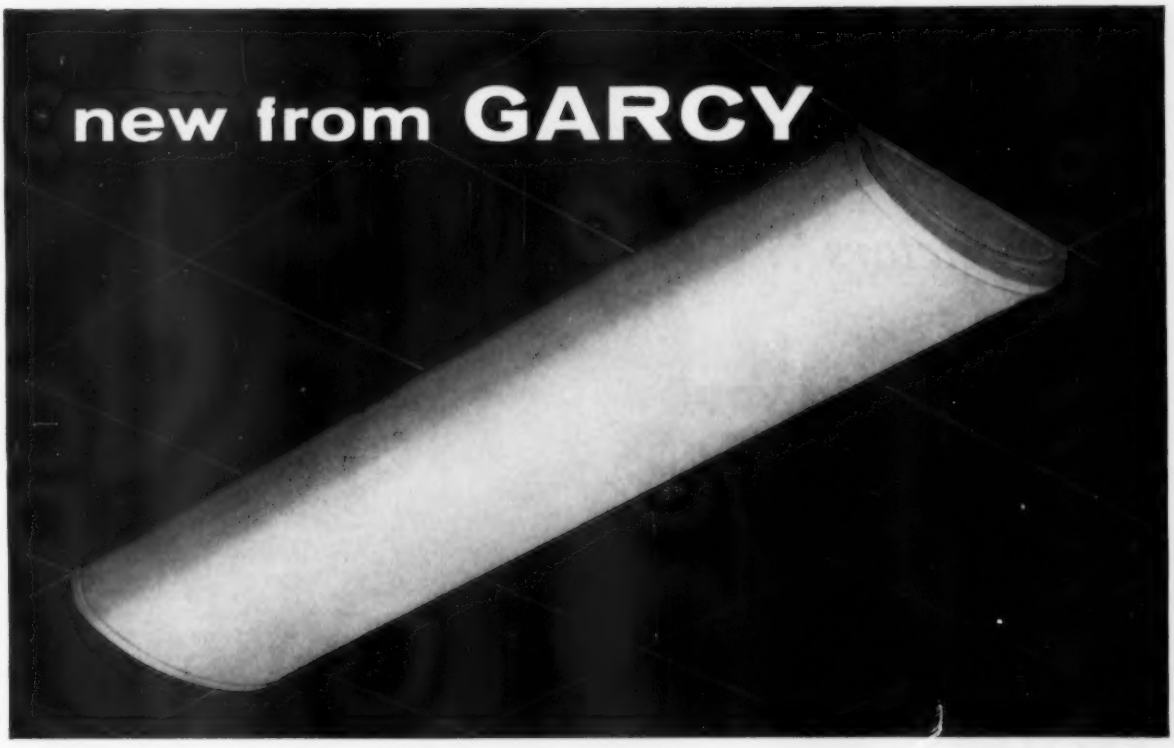
A thick asbestos ring placed over the metal disc at the base of the enclosure serves two purposes. It confines molten metal to an area around the disc and prevents overflow of hot metal on the floor under the test unit.

With this arc tester, K-W mechanics have been able to place up to 900 amps of test load on welders. A dual-range meter at the base of the enclosure measures load amperes in one position and voltage in the second position. Actual field experience indicates the life of a 2½-in. carbon rod to be about two years under normal test use.

Plywood Rack Promotes Order and Cleanliness

A sheet of plywood, secured to the end of an assembly of storage shelves and fitted with hooked-end screws positioned to hold a specific assortment of equipment, promotes orderliness in the shop of Lang Electric in Buffalo, N. Y. By providing "a place for everything", a fast means for visually accounting for all items so supported is created, since a missing tool or item of equipment is instantly noted by its absence from the familiar storage pattern.

Since employees have developed the habit of promptly returning equipment to assigned racks as soon



As ceiling heights go down Ultra-Lux goes up

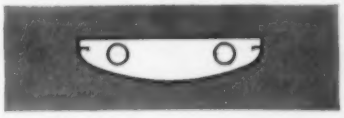
The trend to lower ceiling heights in schools and office buildings calls for a new shallow lighting fixture. Low ceilings rule out conventional pendant mounted units. Shallow ceiling construction does not permit recessed fixtures.

Surface-mounted Ultra-Lux, with its shallow profile, provides an attractive and efficient answer . . . gives a recessed appearance at surface-mounted cost. Its gently curved shield of polystyrene seems to recede into the ceiling.

With its translucent polystyrene shield, Ultra-Lux provides efficient light transmission and uniform distribution. The uniform surface brightness of Ultra-Lux is well within acceptable limits for glare-free comfort.

Light in weight, light in appearance, sturdily built, and easy to install, Ultra-Lux fixtures may be installed in single units or joined in continuous runs. Concealed hinges simplify cleaning and relamping.

Recessed Appearance
Surface-Mounted Cost



GARCY Ultra-Lux
Total Depth 3¼"

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Preferred for Performance
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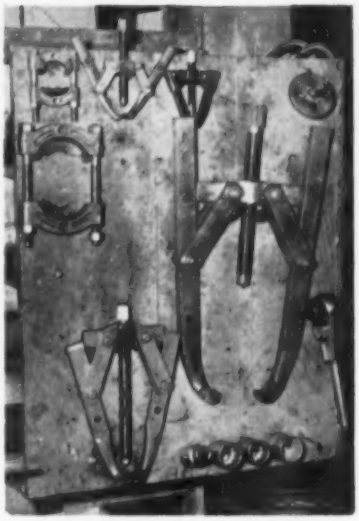


FAMILIAR PATTERN of parts stored in a prearranged, orderly arrangement provides visual check-up for parts in use or unaccounted for. Keeping parts properly racked keeps floors and benches free, parts clean and losses at a minimum.

as a job has been finished, parts are kept off benches and floors, they are seldom misplaced or lost, they remain relatively free from gum-forming dust, dirt, oils and grease, and the general appearance of the shop is improved.

Adjustable Coil Winder Counts Turns

A series of shop-made adjustable coil winders are used in the Consolidated Electric Motor Co., New York City, for its rewinding work. Each device consists of a perforated flat plate, shaft-connected to a

METAL PEGS inserted in drilled plate permit wide variation in size and shape of coil. Largest coil possible on winder shown is approximately 8 by 11 inches; other similar devices with larger plates handle larger coils.

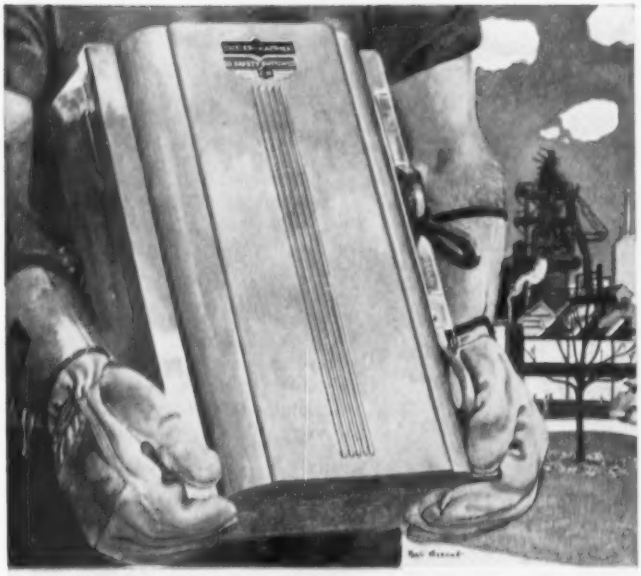
★ ★ ★

This Safety Switch is Built to Match the Performance of the Finest in Motor Control

☆ *installs easier*

☆ *works better*

☆ *lasts longer*



A Safety Switch Worthy of its Name
Cutler-Hammer 4105. Type A. 30 to 1200 Amp.

Engineered for "heat-proof" dependability. New design for minimum internal heat generation; new materials for heat immunity.

Automatic pressure fuse receivers; no screws to forget to tighten . . . no screws to loosen in service by alternate expansion and contraction.

Visible blades for quick and sure inspection at all times. New double insulated steel operating hook. Safety is important in safety switches.

Panel mounted mechanism of the Cutler-Hammer 4105 Safety Switch is readily interchangeable with that of the Cutler-Hammer 4101 to permit replacements without case and conduit work.

Cutler-Hammer Three-Star Motor Control performance has proved sensational wherever and whenever it has been compared with any other control equipment. A kaolin processing plant in Georgia, for example, reports: "Because of the hard service we give motor control in our plant, we have always had to replace contacts every 30 to 60 days. Our first Three-Star Control has now been in daily use for *thirteen months* and its original contacts still look and perform like new." A lumber mill in California says: "Control contacts have always been a problem on our drive of the feed chain going to the trim saw. We had to replace contacts every few weeks. Your Three-Star Control is now in its *twenty-fourth month* of continuous daily operation with the original contacts still in service."

Such control equipment brings important dependability and savings to any job. But it should be matched with a safety switch designed and built to equal the performance. That is exactly what the Cutler-Hammer 4105 Safety Switch offers. It is loaded with advanced design features. See it. Try it. Prove it. Order from nearby Cutler-Hammer Distributor today. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

CUTLER-HAMMER
★ ★ ★
MOTOR CONTROL
C-H

Cutler-Hammer Three-Star Motor Control can now be obtained in every needed form

Cutler-Hammer Authorized Distributors carry stocks of Three-Star Motor Control in sizes and types of enclosures to meet all the usual industrial needs.

Leading machinery builders equip their machines with Cutler-Hammer Three-Star Motor Control as standard original equipment, often as components on panels.

The new Cutler-Hammer Three-Star Unitrol provides for the quickest installation or rearrangement of the finest in control equipment, C-H Three-Star Motor Control.

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EXPANDER

Hammerless setting tool

For easy, secure installation of small and medium size Machine Screw Anchors in tile, concrete and cinder block, and all types of masonry.

The ideal tool for installing anchors in bottomless holes, holes with fragile bottoms, and where ordinary setting tools cannot be used.

Safe anchor installation in hole with fragile bottom
Anchor installed in normal depth hole. Note all anchors are at same depth
Secure anchor installation in bottomless hole

TRADE ARRO MARK

See your industrial, hardware or electrical supplier

ARRO EXPANSION BOLT COMPANY

1540 Boone Ave., Marion, Ohio

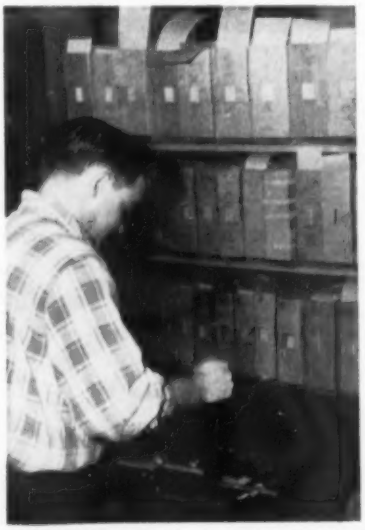
COUNTER, chain-driven by pulley on shaft, records number of turns in coil.

pulley and driven by a fractional-horsepower motor. A direct-reading counter registers revolutions of the shaft and thus the number of turns in the coil.

Adjustment is provided by the many holes drilled in the plate. Slotted metal pegs are inserted in appropriate holes and fastened with wing nuts to produce the desired coil size and configuration.

Pre-Cuffed Paper Is Cut and Folded In Single Operation

A definite time-saver which is highly rated by Buffalo's S. S. Electric Repair Shop is the combination



ONE STROKE of this measuring, cutting, folding device prepares pre-cuffed paper for slot insertion and results in an overall time saving of 15 minutes or more per motor.

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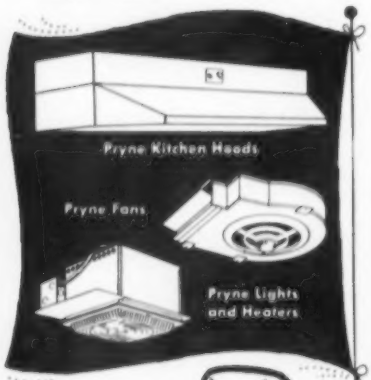

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Address
City Zone State

use of pre-cuffed insulation paper and a related folding-cutting device that measures, creases and accurately cuts paper (thereby preparing it completely for slot insertion) in a single operation.

Since S. S. Electric's stock inventory includes all widths of cuffed paper from 1¼ to 5 inches in ⅛-in. steps, all normal needs are satisfied, all preliminary cutting and folding is eliminated, and time tests indicate that resulting overall savings amount to 15 minutes or more per motor. When related to prevalent wage-scales, these repetitive savings become quite tangible.

It has also been found that paper folded in this manner, with the related folding-cutting rig, has sufficient spring left to keep paper snugly in contact with outer sides of slots, thereby preventing wires of coils from inadvertently slipping down behind the paper. Also, since the pre-cuffed paper is tough, the edges do not easily break down to permit the possible grounding of coils at these critical points.

Coil Cutter Is Useful Shop Tool

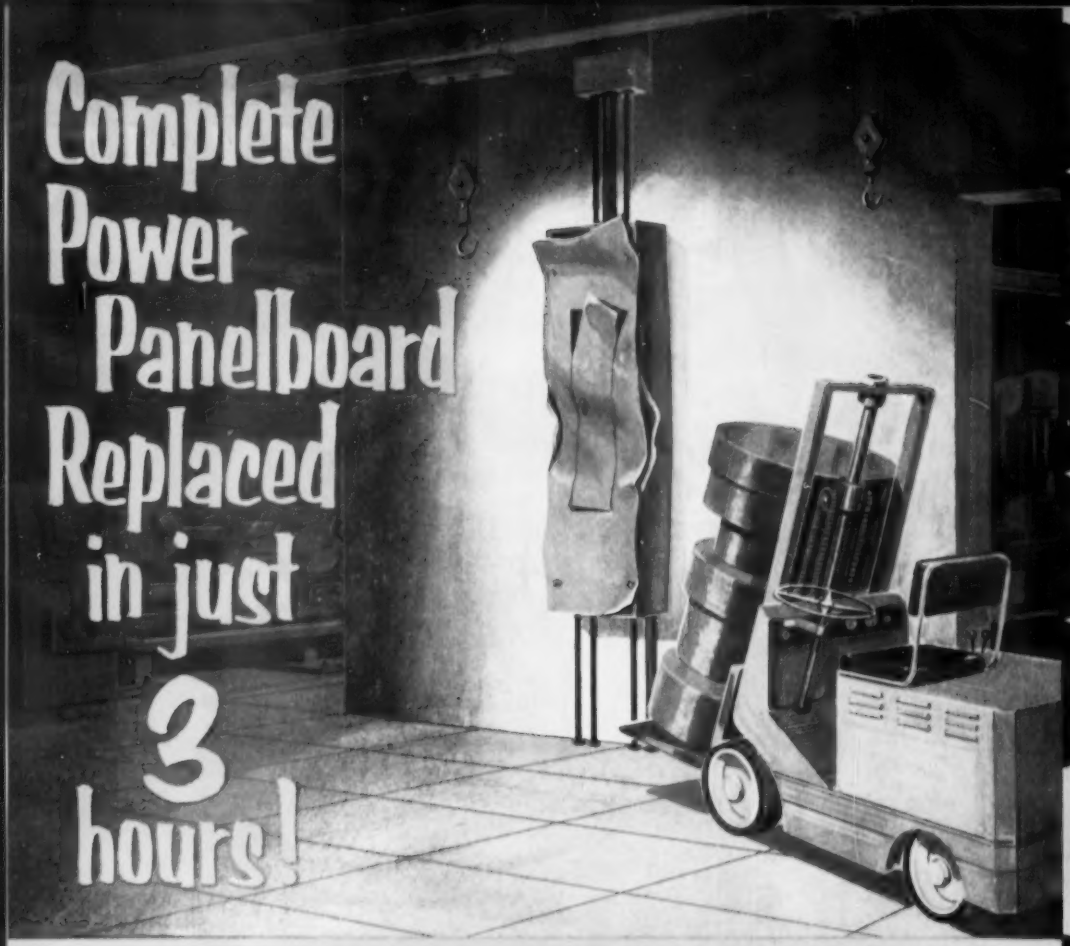
United Electric Motors, Inc., located in Buffalo, N. Y., cuts damaged coil ends quickly and cleanly with the use of a P&R hydraulic rig that operates at a working pressure of approximately 90 psi. Then, with

HYDRAULIC shear is activated by foot pressure, leaving operator's hands free for accurately positioning coils beneath the cutting blade which severs damaged wire loops with 90-psi stroke.

coils thus severed, they can be easily stripped from slots by means of hand tongs. Since the cutter is activated by means of a foot pedal, the worker has both hands free to rotate or otherwise manipulate an armature, or position the motor being stripped at the time. The cutting blade automatically returns to the open position after each cutting operation, so the operator need only concentrate on positioning the work and pressing his foot for action. This unit is sturdily constructed, compact and neat in design, and constitutes a time-and-energy saver.

PEG BOARD RACK holds miscellaneous assortment of large tools in the motor repair department of Koontz-Wagner Electric Co., South Bend, Ind. Board, mounted to wood frame on side of bake oven, tilts about 15 degrees to vertical; is 6 ft tall and 7½ ft long; solves tool storage problem. Wire hooks supporting tools can be shifted quickly to new arrangements for additional items. Pipe guard rail in front keeps equipment on shop dollies from raking off tools near base.

Complete Power Panelboard Replaced in just 3 hours!



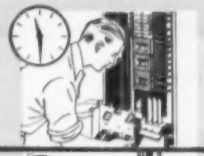
. . . thanks to STABREAKER

Suppose a freak accident completely destroys the power distribution panelboard in a plant. Production, of course, stops cold! And every minute that the panelboard remains out of commission, production costs mount higher and higher. It's imperative that the damaged panelboard be replaced as quickly as possible. Here's how the problem can be solved in a fraction of the time ordinarily required.

9 A.M. Electrical Contractor Arrives—Damage is surveyed. Specifications drawn-up for a new panelboard. Old panelboard is removed.

9:30 A.M. STABREAKER Components Purchased from Local Distributor—STABREAKER enclosures and circuit breakers immediately available.

10 A.M. Panelboard Installation Under Way! New STABREAKER enclosure mounted and wired up in about an hour.



11:30 A.M. STABREAKERS Plugged in Place. STABREAKERS are simply plugged-in and wired up . . . the trim fastened . . . and the job is completed.

12 NOON Service Restored! In only 3 hours! And the cost? Far less than that of factory-assembled panelboard installations.

Apply the advantages of STABREAKER to your particular needs. The combination of STABREAKERS and prefabricated STABREAKER panel enclosures provides you with the fastest, most economical method of obtaining the most flexible system of lighting and power distribution panelboard ever devised!

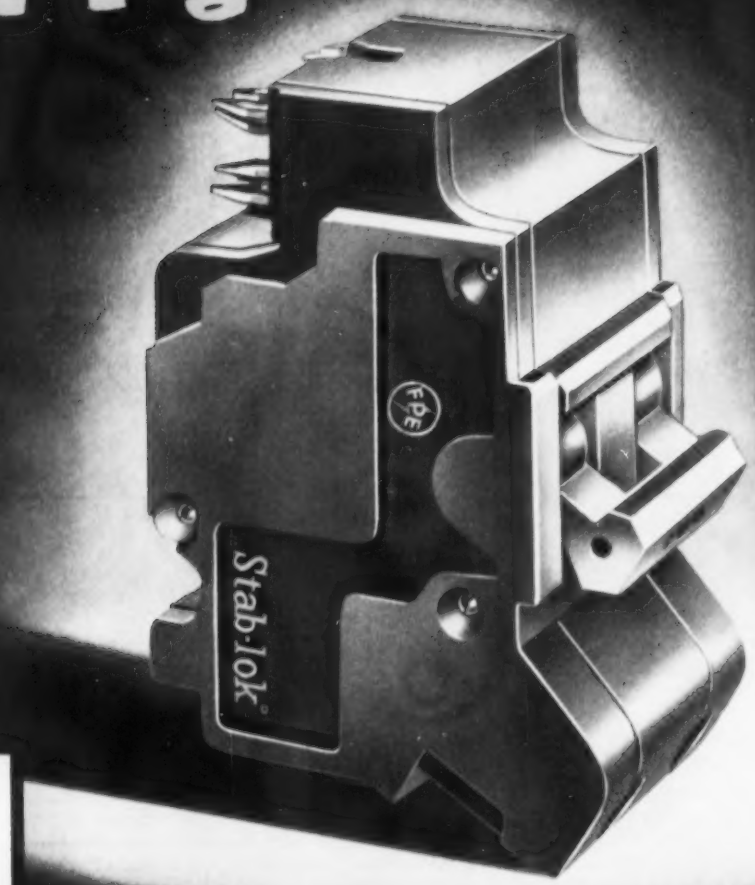
Finest Products Engineered

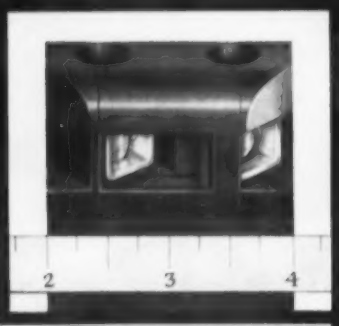
FEDERAL PACIFIC ELECTRIC

COMPANY

Main Office: 50 Paris Street, Newark 1, N. J.

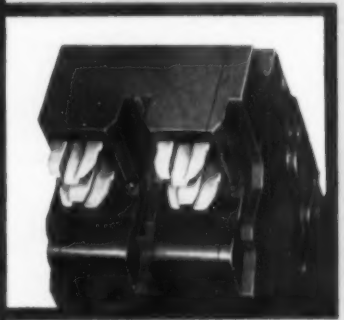
NEW! STAB-LOK 100





New 100 Amp 2-pole Stab-lok, Catalog #2P100. Ratings—100 Amps, 120/240V, 5000 Amps interrupting capacity (also rated at 90 Amps—catalog #2P90).

check these features:



- **ONLY 2" WIDE**—can be installed wherever regular 2-pole Stab-lok breakers are used.
- **FOUR STABS**—the same millions-tested "4-way contact" stabs used on all Stab-lok breakers—only twice as many. Two per phase to accommodate a full 100 ampere rating.
- **ANGLED LUGS**—to facilitate wiring. No groping deep inside the box to wire. Lugs are placed at a convenient angle to speed installation.

Finest Products Engineered

AMP 2-POLE BREAKER

lets you PLUG-IN *a 100 amp "main disconnect" or "branch circuit" in any* STAB-LOK *enclosure!*

"PROGRESS WITHOUT OBSOLESCENCE"! Stab-lok does it again! With the introduction of the *first* PLUG-IN 100 Amp 2-pole circuit breaker, Federal Pacific extends the flexibility of the Stab-lok line *without obsoleting a single item!*

Designed for use in any Stab-lok panel ever produced, this new circuit breaker meets all 100 ampere requirements for "main" or "branch circuit" protection...converts any standard load center into a "main disconnect" panel. What's more—this flexible new Stab-lok saves you money 3 ways:

1. Lower initial cost!
2. You stock only one breaker instead of two!
3. You stock only one panel instead of two!

plus

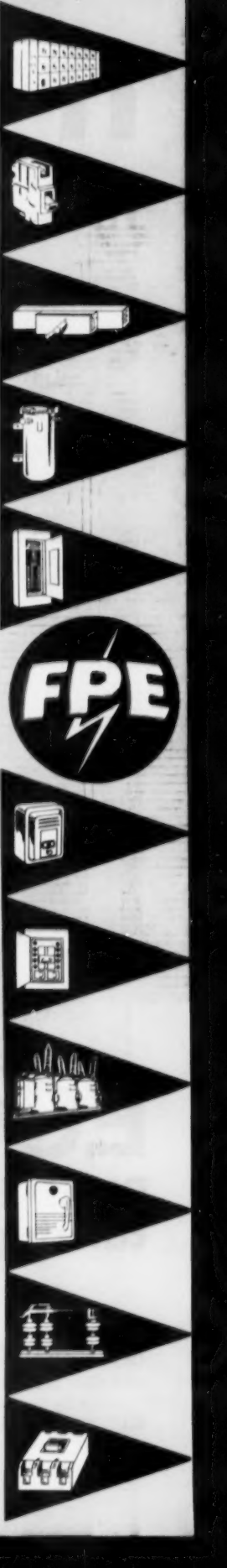
2 new STAB-LOK Enclosures

CATALOG #124

This new sequenced bussed Stab-lok enclosure was developed to be used with the new 2P100 to provide a 100 ampere main circuit breaker disconnect with 20 branch circuits. When used as a load center, this panel accommodates a maximum of 28 branch circuits (twenty 1" NA and eight ½" NC or twelve 2-pole or combinations). Also in Raintight.

CATALOG #1000

This Stab-lok enclosure was primarily designed to house the Stab-lok 2P100 circuit breaker. The complete device will meet all of your 100 amp., 2-pole disconnect requirements and substantially reduce your inventory investment. Enclosure is combination flush-surface...has 100 amp. main lugs ...also available in Raintight.



FEDERAL PACIFIC ELECTRIC

COMPANY

Main Office: 50 Paris Street, Newark 1, N. J.

IT THINKS with a difference that means extra protection!

ECON-ALLOY makes the Difference!
When current overload is continued beyond the safe and pre-determined time, exclusive Econ-Alloy breaks the circuit by changing directly from solid to liquid. The usual plastic stage is eliminated, insuring faster, more accurate protection against overloads and shorts.
• Cut Fuse Costs
• End Needless Fuse Blows
• Eliminate Down Time
* Fast Short Circuit Protection

ECON®
DUAL-ELEMENT cartridge fuses

With the exclusive, *different* Econ-Alloy thermo element acting as the "brain" of the ECON Dual-Element Fuse, you get *double* protection: accurate, "timed" protection against overloads (up to 500%)—and *instant* breaking action on shorts.

Economy Dual-Element Fuses are specially engineered for motor, branch and feeder circuits—save time and money where you have frequent power surges, or the risk of high fluctuation in load.

Available in knife and ferrule types: 0 to 600 amperes; 250 and 600 volts. Approved by Underwriters' Laboratories, Inc.

Write for ECON Dual-Element Catalog S-60 . . . or literature on all Economy Fuses.

ECONOMY FUSES FOR EVERY PURPOSE

1459

Order ECON Dual-Element and other Economy Fuses directly from your ELECTRICAL WHOLESALER

ECONOMY FUSE & MFG. CO., 2717 Greenview Avenue, Chicago 14, Illinois

Data Sheet

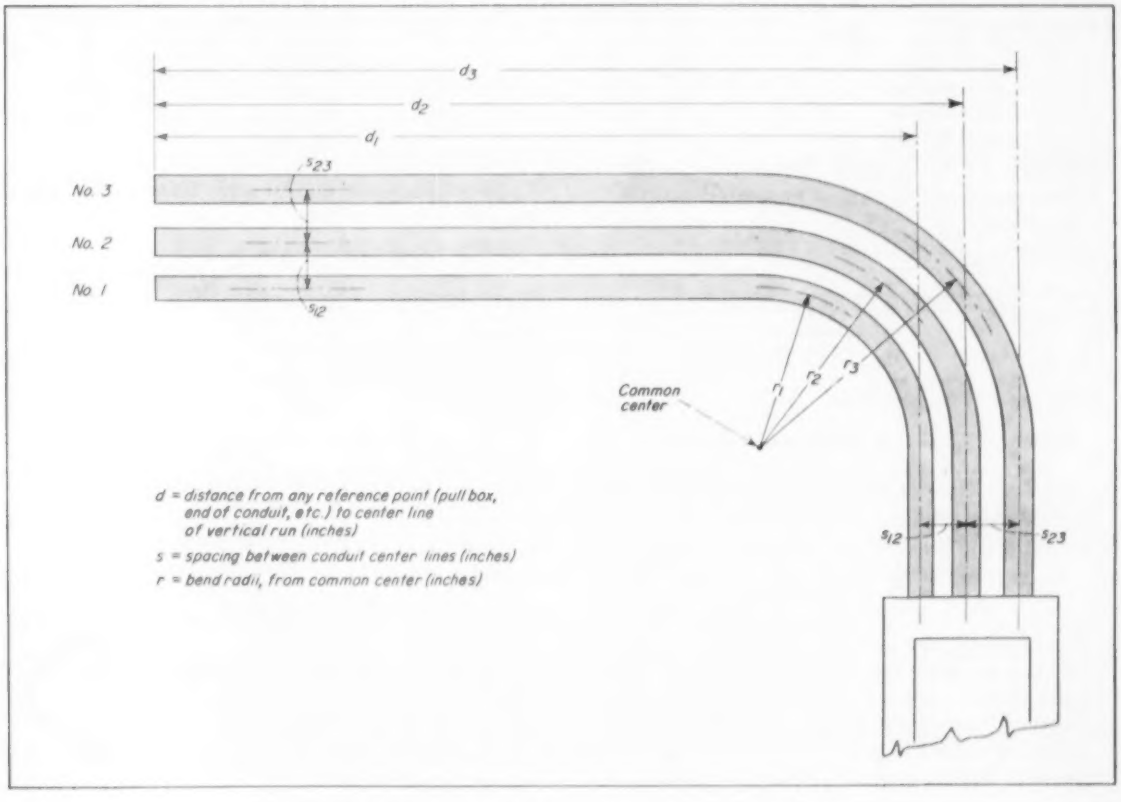
Concentric Bending of Rigid Conduit

Two simple formulas aid in making precise, workmanlike bends in parallel conduit runs, maintaining equal spacing between runs, with hand or power bender.

Installations of groups of parallel conduits requiring a change of direction usually employ field-bent elbows rather than standard elbows to maintain equal spacing between runs. The accompanying diagram is typical.

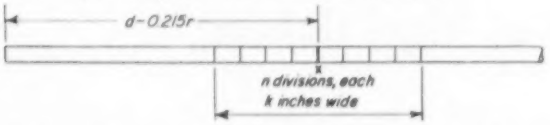
Distance d is determined by job conditions; r is governed only by minimum bend radius requirements of Sec. 3470, N.E.C.; spacing s may be governed by knockouts, width of panelboard, etc. (See *Electrical Construction and Maintenance*, Sept. 1955, page 207.)

Power bending tools are usually used for larger sized conduits. Those employing bending shoes of various radii can accomplish desired bends quite easily; however, where such shoes are not available the radius must be achieved by a series of short bends. Following is a method of obtaining accurate concentric bends of any radius to produce neat, workmanlike, multiple conduit runs.



Bending Procedure

1. Lay off point x on conduit at a distance $d-.215r$. This point represents the center of the bend.



2. Lay off n spaces on conduit, each equal to k and centered on point x.

$$n = \frac{1.57r}{k}$$

Choose value of k from the following table:

r (inches)	k (inches)
4 to 6	1
7 to 25	1½
26 to 45	2½
46 to 60	3½

3. Using these division marks as centers, make a bend at each mark, beginning at the middle of the bend and alternating from one side to the other until a total bend of 90 degrees has been obtained. Check against steel square, previously marked chalk pattern on floor, etc., before completing last few bends. Adjust these to make up for any small existing discrepancy. Each bend should be approximately equal to B degrees, where

$$B = \frac{90}{n+1}$$

Note: Where a bending angle A other than 90 degrees is required, the formulas above become

$$n = \frac{.0174rA}{k}; \qquad B = \frac{A}{n+1}$$

Example

Assume an installation is to be made similar to that shown in the diagram on the first page, in which

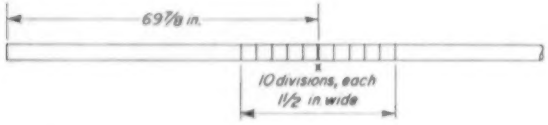
No. 1 is 1½-inch conduit; r_1 is 10 in.; d_1 is 72 in.
No. 2 is 1½-inch conduit; s_{12} is 2¾ in.
No. 3 is 2-inch conduit; s_{23} is 3⅛ in.

It follows that

$r_2 = r_1 + s_{12} = 12\frac{3}{4}$ in.
$r_3 = r_2 + s_{23} = 15\frac{7}{8}$ in.
$d_2 = d_1 + s_{12} = 74\frac{3}{4}$ in.
$d_3 = d_2 + s_{23} = 77\frac{7}{8}$ in.

Conduit No. 1

1. Mark point x at $d_1 - .215r_1 = 72 - 2.15 = 69.85$ or $69\frac{7}{8}$ in.



2. Since $r_1 = 10$ in., $k = 1\frac{1}{2}$ in.

Then $n = \frac{(1.57)(10)}{1.5} = 10$ (disregard remainder)

Thus, 5 divisions are laid off on each side of x, each being 1½ in. wide.

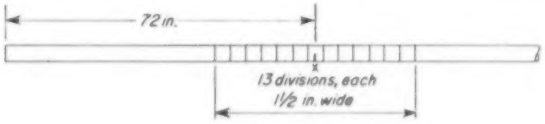
3. Substituting in formula,

$$B = \frac{90}{n+1} = 8.2 \text{ degrees}$$

By making appropriate adjustments on the bender or by using an angle bend gauge, make an 8-degree bend at each mark, starting at x and working alternately on the right and left of x. The first 9 bends will make a total bend of 9x8 or 72 degrees; 2 additional bends 9 degrees each will make the necessary 90.

Conduit No. 2

1. Point x will be at $d_2 - .215r_2$ or 74.75 − 2.75 or at 72 in.



2. $r_2 = 12\frac{3}{4}$ in.; $k = 1\frac{1}{2}$ in.

$$n_2 = \frac{(1.57)(12\frac{3}{4})}{1.5} = 13$$

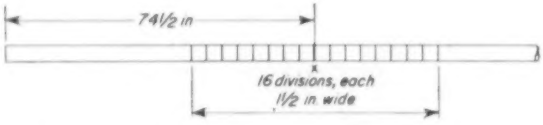
Center one space on point x; lay off 6 on either side of the first.

3. $B = 90/14 = 6.4$ degrees.

Starting at either side of x, make 12 bends at 6 degrees, 2 at 9 degrees for a total of 90.

Conduit No. 3

1. Point x will be at $d_3 - .215r_3$ or 77.875 − 3.413 or at 74½ in.



2. $r_3 = 15\frac{7}{8}$ in.; $k = 1\frac{1}{2}$ in.

$$n_3 = \frac{(1.57)(15\frac{7}{8})}{1.5} = 16$$

Lay off 8 spaces each 1½ in. wide on each side of point x.

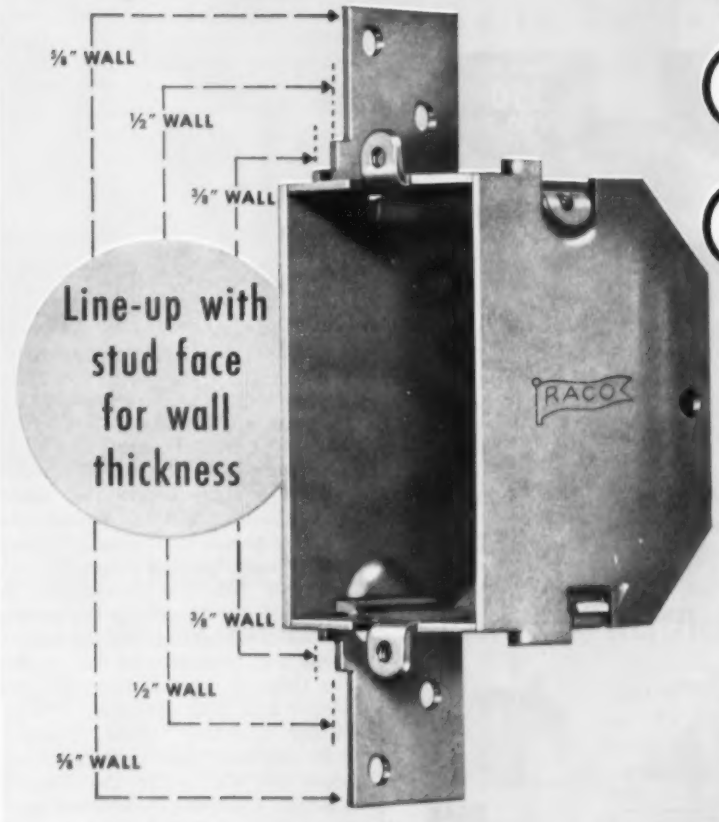
3. $B = 90/17 = 5.3$ degrees.

Starting at x, make 13 bends at 6 degrees, 4 at 3 degrees for a total of 90.

ONE SWITCH BOX FOR EVERY TYPE OF WALL

NEW VERSATILE RACO #491 BOX

FOR DRY WALLS! FOR PLASTER WALLS!

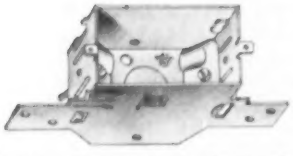


1. PLACE ON STUD
2. LINE UP MARKS
3. NAIL IT DOWN

INSTALLED TRUE AND SQUARE . . IN A FEW SECONDS

Two Nails Will Hold!

Five Nails For Most Rigid Mounting!



Bracket is integral part of box side

Save time and money on every job with this new, versatile Raco No. 491 Switch Box. Self-gauging Raco D Bracket aligns box true and square. Bracket and box are one-piece for added strength . . . non-gangable. A roofing nail in each end of the bracket and a 16-penny nail through the box hold it solid for installing rock-lath.

WRITE FOR FURTHER INFORMATION

ASE RACO

"A RACO BOX FOR EVERY NEED"

ALL-STEEL EQUIPMENT INC. Aurora, Illinois

SOLD ONLY THROUGH AUTHORIZED ELECTRICAL WHOLESALERS

UNUSUALLY SHALLOW

GROUNDING DEVICES

Designed For Panel Mounting

The No. 5258, 125 volt, parallel slot receptacle (and its companion unit, the tandem slot 250 volt, No. 5658) is a competitive, yet very rugged, single, flush-mounted device designed for grounding exposed metal parts of portable electrical equipment. It is side wired with green grounding terminal binding post.

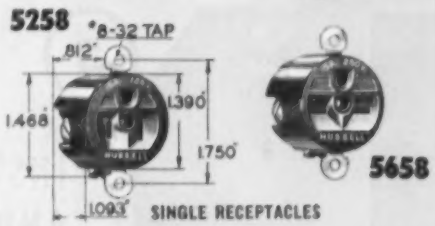
Each unit, when fitted with mounting flange, makes up a new female motor base, Cat. No. 5256 and No. 5656.

Male motor bases (No. 5288 and No. 5668), fitted with "U" shaped pin for grounding, are designed for use with 3-wire, grounding-type cord, connector bodies.

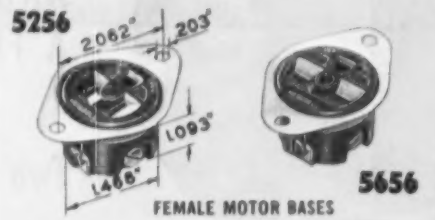
- Round "Shoulderless" design permits mounting in restricted spaces.
- Unusually shallow depth
- Green hexagonal grounding screw
- Rugged bakelite construction
- For use with metallic or non-metallic wiring systems

Parallel Slot 125 VOLT 15 amp.

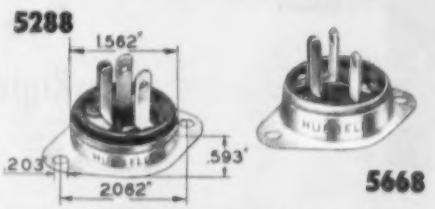
Tandem Slot 250 VOLT 15 amp.



SINGLE RECEPTACLES



FEMALE MOTOR BASES



MALE MOTOR BASES

HARVEY HUBBELL, INC.

HIGHEST QUALITY WIRING DEVICES • MACHINE SCREWS

DEPT. C-1 BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE WAREHOUSE LOCATIONS ASSURE NATIONWIDE STOCK AVAILABILITY

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Chicago 7, Illinois
37 South Sangamon Street

Los Angeles 12, California
103 North Santa Fe Avenue

San Francisco, California
1675 Hudson Avenue

Dallas 7, Texas
1111 Dragon Street

ELECTRONIC LIGHTING CONTROL

[FROM PAGE 103]

cessed approximately 7 ft from these vertical surfaces. Beam patterns are trimmed to shape and size by shutters on all four sides of each fixture; apertures are equipped with pastel-colored filters, and these units are pushbutton controlled (from either of the two control points) through a motorized dimmer.

Rounding out the overall lighting plan is the inclusion of several interesting treatments in the adjoining cocktail lounge, where illumination is provided by conventional coves and downlights, plus pinhole spots (equipped with 20-watt 30-volt R-12 airplane reading lamps and gold-painted enclosing fixtures), and several ultra-violet wall projections.

225-KVA Service Capacity

Primary electrical service for this lighting installation is received at 4160 volts, with a 225-kva transformer stepping current to 3-phase 4-wire 120/208 volts for general ultilization. Power continues through a 3200-amp main air circuit breaker to the 15-section magnetic-amplifier dimmer assembly, also to a main distribution board and, thence, to local power and lighting panels strategically located throughout the club property.

Credit for this installation is four-fold, for it reflects the efforts of Century Lighting and the author (who was in charge of the project for Century as C-lectochrome designer and color consultant); Vorlander Lighting (New England field engineer and project supervisor for Century); the Dorgan Electric Company (electrical contractor responsible for the physical installation), and Stanley Blinstrub (owner of the club) whose vision and faith in the promotional-power of good lighting was tangibly evidenced by his investment of over $50,000 in an overall project and in specific items of equipment which were not yet designed at that time. The worth of that investment is now dramatically clear, for attendance records have piled high since this new lighting system was installed, and reactions of patrons and performers alike have been enthusiastic.

FOR SIGN CONNECTION, Sealtite flexible, liquid-tight conduit was run through the masonry of building to sign. Electrical contractor: Rogers Electric Contractors, Birmingham, Ala.

Contractor Speeds Electrical Installation

with Sealtite Flexible, liquid-tight conduit

In the time it takes to bend rigid conduit to shape, Sealtite* flexible, liquid-tight conduit is in and the electrician is out—ready for another job. The speed and ease of installing Sealtite—particularly in close quarters—is one reason Rogers Electric Contractors uses it on many jobs.

For example: 3" type E.F. Sealtite was installed by Rogers to carry all power cables and wiring to a sign on the Protective Life Insurance Company building, Birmingham, Ala.

Here, Sealtite's tough, extruded jacket shrugs off rain, sun and dirt—protects wiring from corrosion and foul-up . . . and the flexible conduit absorbs vibration and shock.

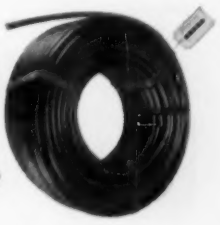
TYPE U.A. Tough, extruded cover protects wiring from moisture, oil, dirt, chemicals and corrosive fumes. Copper conductor wound spirally gives positive ground inside the conduit.

WANT TO KNOW MORE? Electrical wholesalers stock Types U.A. and E.F.† Sealtite flexible, liquid-tight conduit in easy-to-handle coils. Be certain you ask for and get the quality conduit marked "Sealtite." Buy it in long lengths and cut it on the job without waste. Special liquid-tight connectors by Appleton, Thomas & Betts, Gedney or Pyle-National are available. Free Booklet S-537 gives full information on Sealtite. Write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: Sealtite is approved by Canadians Standards Association, and sold by Anaconda American Brass Ltd., New Toronto, Ont.

*Trademark †Pat. Applied For 87187

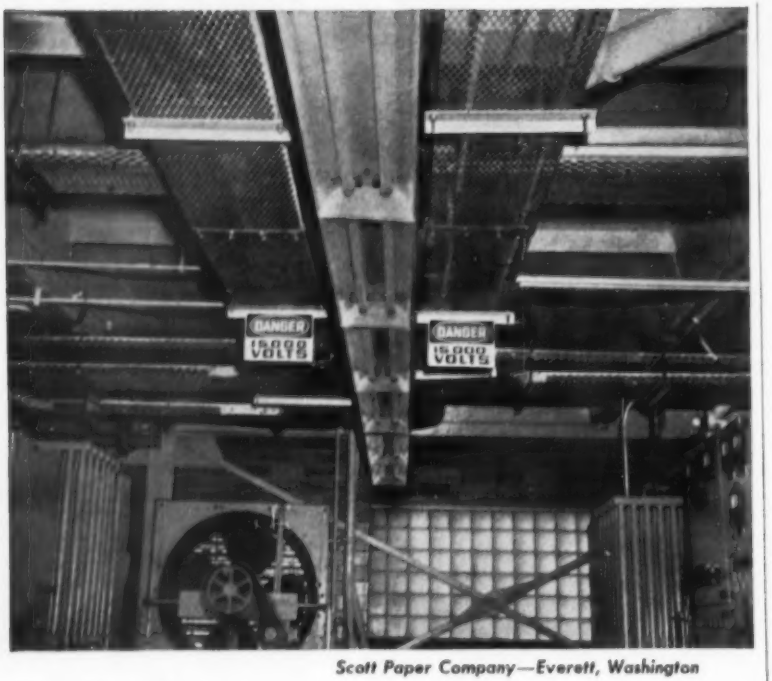
Insist on the original

SEALTITE



flexible, liquid-tight conduit

An **ANACONDA®** Product



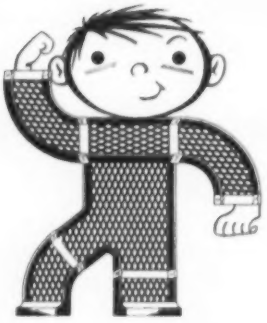
Scott Paper Company—Everett, Washington

How to

POWER UP with COPE

Paper mills are noted for their large use of power. Power engineers in the pulp and paper business know how to conserve materials and still guarantee long, trouble-free service. They can't afford a power breakdown.

More and more consulting engineers are specifying Cope Cable Trough to support power and control cables. Specify Cope on your next job.



***Tommy Cope says:* "Keep your voltage high with Cope. You'll keep your costs low."**

C-617

Our engineers are ready to work with you. Write us today for full details on Cope Cable Supporting Systems.

T. J. COPE, INC.

COLLEGEVILLE 5, PENNSYLVANIA

Cope

MAINTENANCE OF PRIMARY CIRCUIT BREAKERS

[FROM PAGE 115]

2. Apply oil to pins and grease to zerk fittings.
3. Lubricate mechanism guide rails.
4. Check all air lines for leaks or need of tightening.
5. Operate manually and check for friction.
6. Check control details for loose connections, friction in relays or frayed insulation.
7. Operate breaker electrically observing air loss. Normal air loss is 2 lbs per closing operation and 25 lbs for tripping.
8. Drain valves should be checked to remove moisture.
9. Visual inspection of fiber arc splitters should be made periodically to determine whether fiber arc splitters need to be replaced. Sharp instead of rounded edges indicate need for replacement.

Circuit breakers are usually operated and timing tests made during installation. The timing tests may be made by using any one of several timing devices such as cycle counter, standard timer, oscillograph, travel recorder or various other devices. The factory chart when supplied and the installation chart are usually filed with a particular breaker record for reference. The most common practice is to not make new travel records on maintenance inspections unless adjustments are changed or new parts are installed. The accuracy of a travel record chart is highly dependent upon the calibration, maintenance, and installation of the timer. The accuracy is usually adequate for comparative field work. In analyzing, record:

1. All operations start at zero time on chart.
2. Each horizontal space represents ½ cycle for high speed setting and one cycle for slow speed.
3. Solid line represents trip operation.
4. Broken dot dash is a closing operation.
5. Broken dash line is a reclosing operation.
6. Broken dot dash line close and open is a trip-free operation.
7. Average contact speed through the arcing zone is determined by super-imposing a straight line through the two points (A and B for five-cycle breakers and A and C for eight-cycle breakers).

Here's Why Square D's New Adjustable

ALUMINUM FEED-IN DUCT

makes a lot of sense to me!

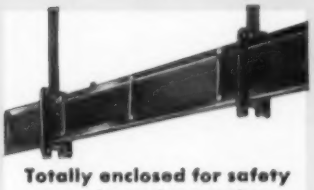
Needed-Rush!
85 feet, 3½ inches
1000 Amp, 3ϕ4 wire
Feed-In Duct

Telescoping joints with multiple slots permit infinite adjustability up to 12 inches when other than standard lengths are required. Standard elbows, T's and X's telescope up to 6 inches!

Fast delivery because any length requirement can be met with standard 3, 5, 7, or 10 foot lengths, plus telescoping joints

Faster to install - Above photo of fixed joint shows simplicity of design—symmetrical ends—less bars per phase—fewer connections—outward-facing captive bolts

Completely adjustable after it's hung. For example, if two ends terminate 6½ inches apart, connection can still be made with a telescoping joint



Totally enclosed for safety —at no price premium. No de-rating necessary. Square D's design eliminates need for ventilation

MORE DESIGN FEATURES

- Thinnest cross-section available! Tight spots, pipes and structural members present less problems
- Easy transposition of phases, using standard telescoping joint parts, for maintaining balanced voltage on long runs
- Certified short circuit tests by an independent testing laboratory have proved the superiority of Square D's continuously-supported bus design

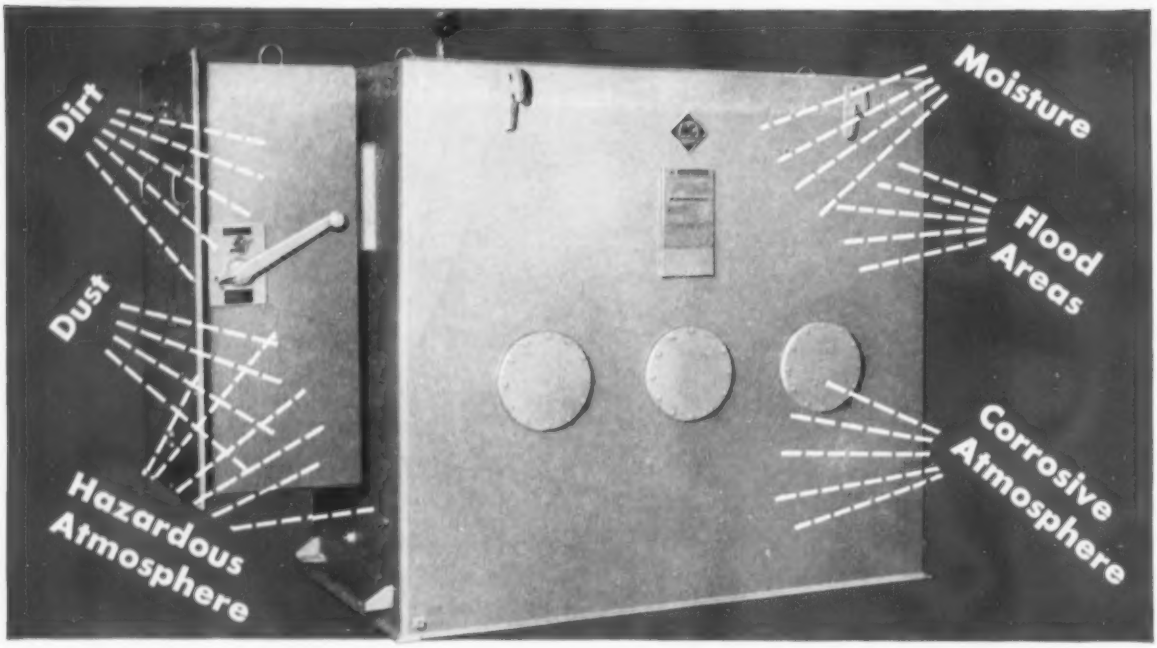
Write for the complete story
Address Square D Company, 6060 Rivard Street, Department SA, Detroit 11, Michigan

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE

SQUARE D COMPANY

ALLIS-CHALMERS
Sealed
Dry-Type
Transformers

Designed for the *Toughest Spot* In Your Plant



SAFE in any location regardless of Atmosphere or Moisture Conditions

Here's a transformer you can safely install anyplace without worries.

● **Fire or Explosion Hazard Eliminated** — Unit is hermetically sealed in inert-dry-nitrogen atmosphere.

● **Completely Protected**—Can be placed safely in flood areas, dirty and contaminated atmospheres, or in open work areas without vaults or barriers.

● **Insulation Life Increased** — Core and coil assembly is sealed in inert gas. Eliminating oxidation reduces thermal aging of insulation.

● **Maintenance Requirements Cut** — Elimination of cooling tubes and use of smooth tank surface reduce paint area as much as 60%. No internal liquids to maintain. All-welded construction. Number of gasketed openings reduced. Cleaning of core and coil eliminated. For these reasons, unit can be installed in hard-to-get-to places.

● **Low Installation Cost** — Unit is ready to be energized immediately upon delivery, after check to make certain no damage or leaks have occurred during shipment.

Allis-Chalmers transformers have an outstanding record of satisfying thousands of users all over the country. You can get the complete story on Allis-Chalmers sealed dry-type transformers from your local A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-5035

ALLIS-CHALMERS

LIVE BETTER ELECTRICALLY

FOR MORE INFORMATION ON

NEW PRODUCTS
CATALOGS, BULLETINS
ADVERTISEMENTS

USE THESE CARDS

- **PRODUCT NEWS, PRODUCT BRIEFS:**

  Use first line of boxes. Insert item numbers of products on which more information is desired.

- **CATALOGS, BULLETINS AND ENGINEERING DATA:**

  Use second line of boxes. Insert item numbers of literature desired.

- **ADVERTISEMENTS:**

  Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

IMPORTANT...

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- USE BLACK OR DARK BLUE INK
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The Editor
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.,
New York 36, N. Y.

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The Editor
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.,
New York 36, N. Y.

Your Name and address will be reproduced and sent to the appropriate manufacturers. Illegible or incomplete addresses may result in your not receiving the information you desire.

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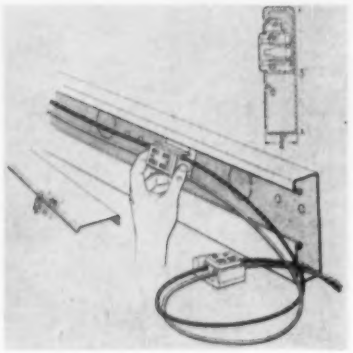
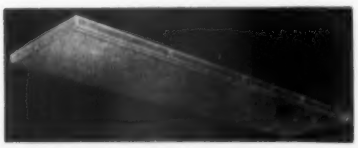
Product News



Wiring System (1)

Baseduct is a new, complete electric wiring system at the baseboard level where it is most convenient and least conspicuous. It is designed to handle household electrical requirements which are now as much as five years in the future. This system is installed directly on the floor and requires no footers, trim, nor capping of any kind. Three fittings are required to mount the Baseduct System: an end blank, a combination internal and external elbow for corner areas and a standard coupling. Available in 5-ft lengths, with duplex receptacles on 30- or 60-in. centers. Overall dimensions are 3 in. high and ¾-in. wide. Receptacles used within the system are preassembled to wiring harness at factory. Mounting holes in base provide for easy installation of system. ¾-in. knockouts in base of duct facilitate wiring operations. Raceway in lower area of Baseduct is sufficiently roomy to house a maximum number of wires for all normal branch circuit requirements. Wires are contained within body of duct without retaining clips. It is finished in satin gray and can be painted to achieve any other desirable color or color combination. U.L. approved.

National Electric Products Corp., Gateway Center, Pittsburgh, Pa.



Lighting Fixture (2)

New Trimline series of shallow fluorescent lighting fixtures, designed to complement contemporary interiors. They feature invisible hinges and one-piece steel sides with plastic windows. Intended primarily for mounting directly on the ceiling, the series may also be pendant mounted for direct-indirect lighting systems with reduced brightness ratios. The series is offered in over 1750 different models, including 12-in, 18-in, and 24-in. widths and 4-ft or 8-ft lengths. Light control mediums include framed metal louvers with 30° by 35° shielding, miniature-cell plastic louvers with 43° shielding, Holophane lenses, and Corning low-brightness glass. Solid metal sides are also available. Literature is available.

Sechrist Manufacturing Company, 4990 Acoma St., Denver 16, Colo.

Ventilating Hood (3)

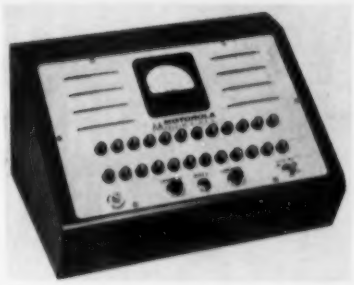
Kitchen hoods feature an exclusive new tarnish-proof, copperized finish. Functionally designed for installation in new or old cabinets, this tilting hood is also available with optional accessories. Hood is available in two basic models. No. 500 with space saving, self-contained light and fan. No. 400 requires only 4 in. of space for fan and light housing. Both models are available in coppertone or other kitchen appliance matching colors, with self-contained, easily accessible light and pushbutton switches.

Pryne & Company, Pomona, Calif.

Current-Limiting Fuses (4)

A complete line of current-limiting fuses with a tested interrupting rating of 200,000 amps symmetrical has been announced. Designed to interrupt short circuit currents in less than a quarter of a cycle these type CLF fuses are for protection of branch feeders, lighting circuits, motor starters, control power circuits and similar applications where conventional fuses do not have sufficient interrupting capacity. CLF fuse is one time low voltage cartridge-type unit with external dimensions which meet the requirements of the NEC and UL. Fuse body is an insulating tube. Silvered copper ferrules or knife blades at each end fit any standard NEC fuse holder of corresponding voltage and current rating 600 amps and below. Above 600 amps tangs are provided for bolt mounting. Fuses are available in ratings up to 4,000 amps.

General Electric Co., Schenectady, N. Y.



Signaling (5)

A single-unit console providing complete selective calling facilities for land-mobile two-way radio base station installations has been added to the "Quik-Call" selective signaling line. It combines all tone signaling elements, including tone generator, timer, power supply and code selector, in a single package. Console can be added to any existing two-way radio system, regardless of make or model. Overall dimensions are approximately 13 in. by 10 in. by 7 in., weight is 24 lbs. With the addition of selective calling facilities, a mobile receiver in a two-way radio system responds only to calls specifically directed to it, and is silenced to all other traffic on the channel.

Motorola, Inc., Communication & Industrial Electronics Div., 4501 W. Augusta Blvd., Chicago 51, Ill.

Gear Motors (6)

Series of industrial gear motors expected to find wide acceptance in a variety of industrial applications including conveyors, elevators, winches and hoisting equipment where there is need for constant torque at a lower speed. Two styles are available, featuring an adaptor end frame or a shovel base. Built in sizes from 1 hp to 30 hp, units will be available in the future in higher hp ranges. Driving power is supplied by an integral motor, built to conform to re-rated NEMA standards.

Delco Products Division, General Motors Corp., 329 East First St., Dayton 1, Ohio

NEW midwest SET SCREW SERVICE ENTRANCE HEAD

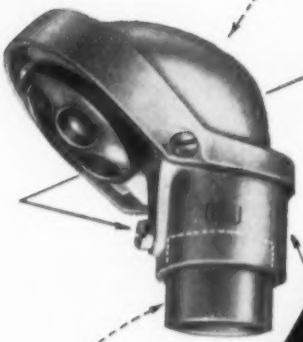
NEWLY DESIGNED HOOD

gives more wiring room — in height, width and radius

Fitting embodies a cadmium-plated, certified malleable iron body, with a pressure cast aluminum hood, for maximum strength and protection

HARDENED HEX-HEAD SET SCREW

(with screw driver slot) prevents head from turning, by direct conduit-to-hub gripping action



LONG HUB

prevents rain from entering conduit

FORMED STEEL ADAPTER

Fitting comes equipped with formed steel adapter for perfect centering on thinwall installations. Adapter is discarded when head is used on rigid

Sizes:

Available with slip hubs to fit all standard conduit sizes from ½" through 2". Sizes 1½" and 2" equipped with two set screws.

THIS NEW HEAD is designed for either rigid or thinwall application. It provides easier and faster installation, because no threading or external clamping is required. Set screw fastener assures firm and positive head support.

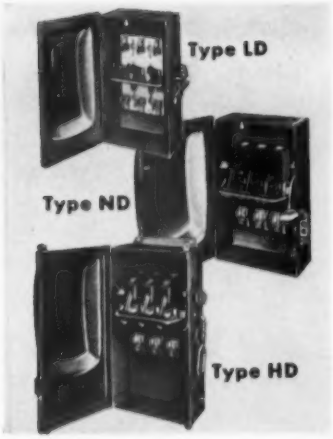
Here is another Midwest development in providing quality fittings. "Quality" is just a condensed way of saying: "Getting the total job done — right — with the most inexpensive combination of material and manhours." Engineering and producing quality fittings to meet the highest standards of electrical wiring requirements, is our objective at Midwest.

Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

1639 W. WALNUT STREET

Chicago 12, Illinois



Safety Switches (7)

A line of safety switches meeting the new NEMA Standards. Type LD for light duty replaces the former D or G types. Line includes a full range from 30 to 200 amps in both general purpose and raintight enclosures. NEC hp ratings are included. Type ND for normal duty and commercial work replaces the former H, S, A, or C designations. The full line extends from 30 through 1200 amps in both 250- and 600-volt, ac and dc, in general purpose or raintight enclosures. Both NEC and dual element hp ratings are included. Type HD, for heavy duty industry use, is a new premium performance switch. Enclosures include the gasketed industrial (NEMA 12) type as well as watertight and dust tight, and explosion-resisting types.

Square D Company, 6060 Rivard St., Detroit 11, Mich.

Lighting Fixtures (8)

New line of vaportight lighting fixtures, the VM series Vapormaster. It is an all-in-one aluminum unit which combines the socket and globe holder and guard. Unit is available in two sizes, one for lamps up to 150 watts and the other for 150-, 200- or 300-watt lamps. The change-over for lamps of less or greater wattage is achieved in one operation. The entire assembly of holder with socket, guard, globe and lamps is removed from the Condulet and the alternate size unit is substituted. Condulet bodies, which will take either capacity unit, come in every necessary arrangement for the fixture—pendant, ceiling, bracket types and with side conduit hubs. Dome, deep bowl, shallow bowl or angle porcelain enameled reflectors are available for both assemblies.

Crouse-Hinds Company, Wolf and Seventh North Sts., Syracuse, N. Y.

Luminous Ceiling (9)

The Magic Ceiling, a completely packaged luminous ceiling, consisting of electrical channels for fluorescent lamps and a steel grid holding a diffusing Wakon-vinyl plastic. It is designed to provide quick, economical, overnight modernization for most interiors. The Magic Ceiling is not attached to the side wall. Available are five sizes from 9 ft by 8 ft to 18 ft by 20 ft. Other sizes are 6 ft by 8 ft or 18 ft by 24 ft to 24 ft by 28 ft.

The Wakefield Company, Vermilion, Ohio

Ventilating (10)

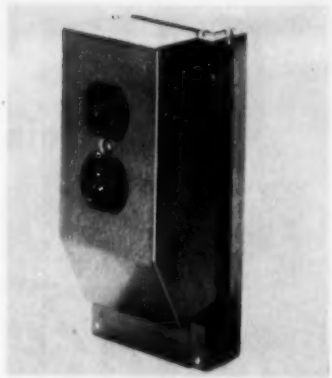
Two new Kitchen-Aire ventilators, single vent KA-155 and multiple vent KA-170. Mounted on the outside of the house, the 1100 CFM KA-170 can ventilate two or three rooms. The 550 CFM KA-155 is intended for single vent operation from grille intakes or range hoods. Both models can be converted for roof installation. Both models are equipped with automatic spring-loaded back-draft damper. Both are equipped with a thermal overload switch.

Stewart Industries, Inc., 320 E. St. Joseph St., Indianapolis, Ind.

Friction Tape (11)

Bull Dog premium brown friction tape offers superior adhesion, high tensile strength, outstanding weathering, high dielectric strength, superior aging and non-ravelling. Packaged in individual cartons with a transparent protective over-wrap, the tape stays fresh. Available in size No. 8, ¾ in. by 60 ft. Literature is available.

Boston Woven Hose & Rubber Co., Boston 3, Mass.



Outlet (12)

A convenience outlet that can be installed in the company's line of baseboard electric heaters. It provides a convenient source of power for room air conditioners, lamps and appliances. Outlet can be installed at any desired location between regular 2-ft-long heater sections. It comes equipped with 120-volt outlets, but can be replaced by 240-volt outlets when desirable.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

Connectors (13)

A new series of electrical connectors makes possible a major reduction of conductor clamp inventories. Heavy-duty U-bolt clamps, employing universal, parallel spacer grooves, now can be used on a wide range of cable sizes. Six Alcoa clamps, designated 580 Series, can be used on ACSR from No. 2 to 715.5 MCM, and will also handle sizes No. 2 to 800 MCM stranded aluminum conductor. All proportions—length of clamps, number of bolts, bolt sizes—are engineered for the range of conductor size to be accommodated and the job to be done. The U-bolt portion, flattened to reduce bulk, provides wrap-around strengthened even pressure distribution.

Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

Again!

Porcelain Products introduces a Brand New Concept

...SWITCH BOXES of FIBER GLASS

- Corrosion Resistant
- Insulating
- Strength
- Economical
- Flame Proof

No. 9311

Plus...

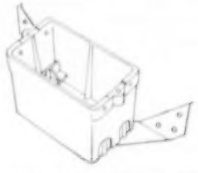
these other fiber glass reinforced plastic (FRP) outlet boxes.

Another addition to Porcelain Products' growing line of boxes is this new fiber glass reinforced polyester switch box. The remarkable qualities of FRP make possible this fully insulated, corrosion and flame resistant switch box that is fully rugged enough to withstand abnormally rough handling. Because the box itself is an insulator, grounding on many circuits is not necessary. Its inherent resistance to corrosion makes it ideal for application in farm buildings, industrial plants, or wherever there is contaminated or moist atmosphere. Write today for complete information!

No. 9314-C, 4" Octagon box, has standard round knockouts . . . available with or without FRP clamps.

No. 9314-H Octagon Box, furnished assembled with hanger bracket. Also available with or without clamps.

No. 9311-E, FRP Switch Box with mounting ears for old work. Standard with FRP clamps. No. 9311-ENC without clamps.



No. 9311-H with hanger bracket for new work. No. 9311-HNC without clamps.

63 years

ELECTRICAL PORCELAIN SINCE 1894

Porcelain Products, Inc. PP INC.

FINDLAY, OHIO

Lighting Fixture **(14)**

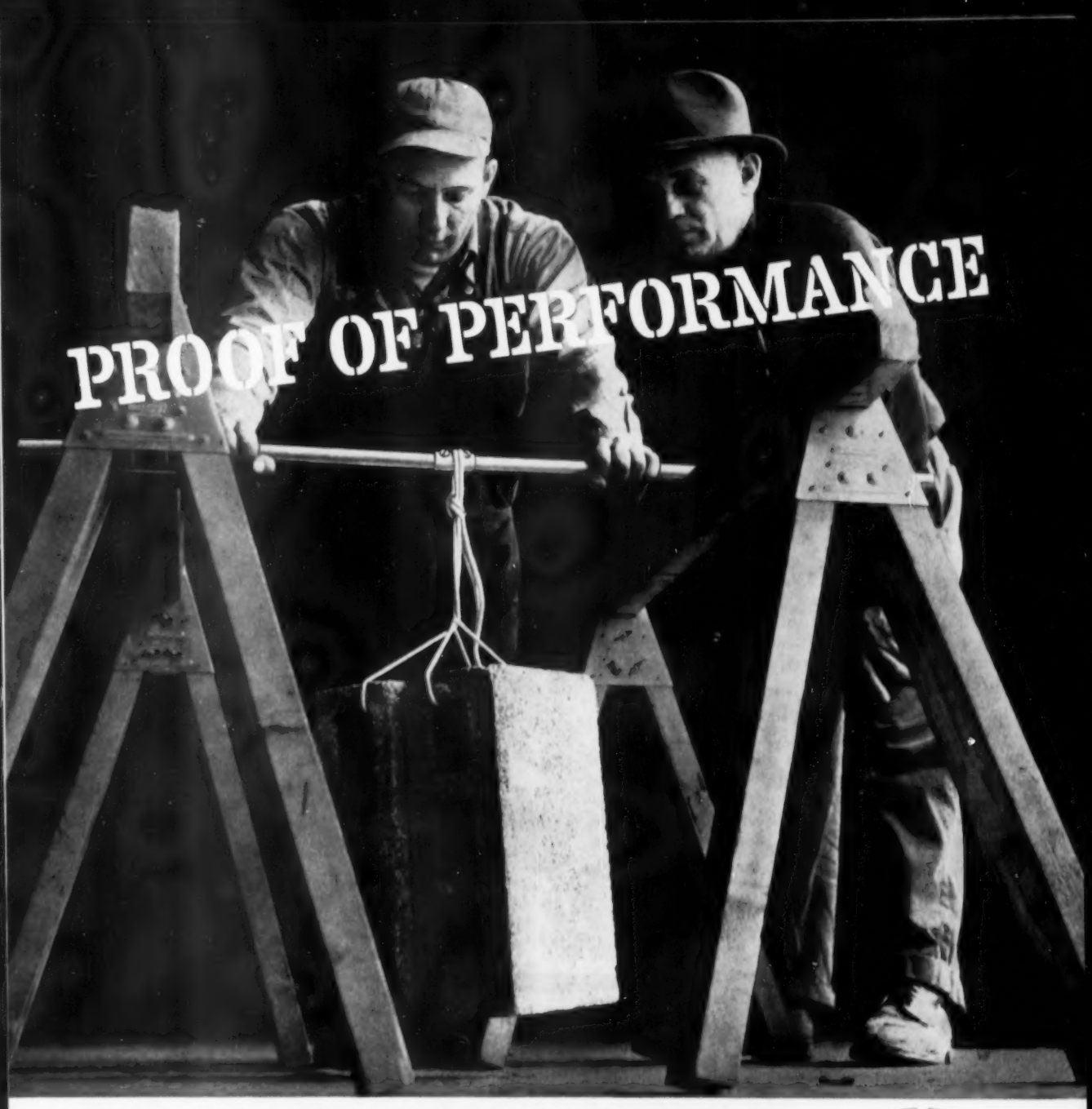
A new shallow surface-mounted luminaire, called the Shallorama. This 4-lamp fixture is a luminous structural element with a depth of 2¼ in. and appears to be a recessed unit with a "dropped" Plexiglas diffuser panel extending below the ceiling line. The diffuser configuration allows illumination to be cast onto adjacent ceiling areas to minimize fixture-ceiling contrasts. In addition to continuous row mounting, these units may also be mounted side-to-side for massed, large area illumination. Normal two-screw mounting is used to secure the fixture to the ceiling; leads are pulled through a large center knockout and connected. Shallorama is 24 in. wide; its width conceals the ballast housing above rather than within the fixture. Diffuser panel may be opened from and hinged at either side, or can remain hanging during maintenance. Other features include new leveling jacks at each corner of fixture to compensate for uneven or irregular ceilings; ballast cover is removable by turning two Cam-lok fasteners. It is available as rapid start only.

Sunbeam Lighting Co., 777 East 14th Place, Los Angeles 21, Calif.

Ventilator Hood **(15)**

Completely pre-wired hoods equipped with solid tops designed with easy breakouts to accommodate the company's model Nos. 3501, 2501 and 1501 ventilators. The pre-wiring feature allows for a simple electrical connection after the hoods are fastened to the cabinet. Lighting is also included as an integral part of the hood, and in addition a 3-speed control operated by a finger-tip touch bar controls both ventilator and light. New hoods are available in both the "Stationary" model in stainless steel and satin copper and the "Salem" model in antique copper.

Trade-Wind Motorfans, Inc., 7755 Paramount Blvd., Rivera, Calif.



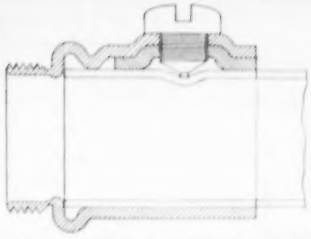
BENDING LOAD TEST SHOWS STRENGTH AND GRIP

of National Electric E. M. T. Fittings

Two lengths of ½" E.M.T. were joined with an NE coupling (all that was needed was a screwdriver) and cinder blocks weighing 54 lbs. were suspended from the joint. The entire assembly was then rolled along the supports with no effect on the coupling's efficiency . . . a convincing demonstration of the strength of the NE fittings. Especially since the Underwriters require only a thirty pound weight for this test.

National Electric E.M.T. connectors and couplings are safe and strong because of the sturdy one-piece pressed steel body and outstanding holding action of the patented NE embedding screw. The contact of the screw in the tubing wall constitutes a safe permanent ground. All fittings are galvanized for full protection against corrosion.

National Electric E.M.T. connectors and couplings are the easy way to assure a quality, uniform installation. Try them . . . they're sold by the leading electrical distributors everywhere.



The outstanding holding action and vibration resistance of National Electric Fittings are obtained when the tip of the patented screw is driven home and embedded in the tubing wall.

Parent No. 2,455,180

National Electric Products

PITTSBURGH, PA.

2 Plants • 11 Warehouses • 35 Sales Offices

TO BUILD YOUR LIGHTING BUSINESS . . .

Enter The 1957 International

Stories on top winning entries will be published in ELECTRICAL CONSTRUCTION AND MAINTENANCE!

Local publicity will stimulate lighting business!

$5,400.00 in cash prizes will be awarded!

Have you completed an outstanding lighting job since January 1st, 1956? Do you have one planned—or working—to be finished before October 25th, 1957? Why not let that job bring you extra profit . . . and industry-wide recognition? Enter it in the 1957 International Lighting Competition!

The competition is open to any individual who is either the owner or manager, or an employee of any of the following types of business, provided he complies with all the requirements outlined in the official rules of the competition: 1. Electrical Contractor. 2. Electrical Wholesale Distributor. 3. Architect or Engineer. 4. Electrical Utility.

The contest opens March 15th, and closes October 25th. Announcement of award winners will be made during the week of November 11, 1957.

The competition is sponsored by three McGraw-Hill publications: Electrical Construction and Maintenance . . . Electrical Wholesaling . . . Electrical World . . . with the cooperation of the National Lighting Bureau (National Electrical Manufacturers Association).

Commercial, industrial and institutional lighting installations winning cash prizes will be certified by the National Lighting Bureau, NEMA, providing the installation plans meet certification standards. Certificates will be presented to all cash prize winners, and honorable mention winners. In case of tie, duplicate awards will be made. Wherever practical, awards will be made locally; if possible at electrical group meetings.

Send in the coupon below for detailed information on the 1957 International Lighting Competition. Make your outstanding lighting job pay off in extra cash, and valuable public acclaim!

LIGHTING CLASSIFICATIONS:

Lighting installations are divided into six separate and individual groups. Separate awards will be made for each classification, within each contestant division. The installation classifications are:

1. **Industrial**
2. **Store**
3. **Office**
4. **Institutional**
5. **Outdoor Lighting**
6. **Residential Lighting**

PRIZE AWARDS:

The 120 cash prizes offered, total $5,400.00. There are five prizes for each of the six installation classifications, and these prizes are offered within each of the four contestant divisions. The prize awards for each classification and within each division:

First Prize: $100

Second Prize: $50

Three Prizes: $25 each.

JUDGING:

Competent and fair consideration for each entry has been assured through appointment of nine individuals, each a well-known authority in the field of illumination, to serve as judges. These individuals will form three panels of three members each, to judge the separate lighting classification groups. The decisions of the board with respect to awards and all other competition matters are final and binding on each participant. The competition and awards are subject to all applicable local, state and federal laws and regulations.

Lighting Competition!

OFFICIAL COMPETITION RULES:

RULE 1 — Application to enter the Competition must be made in writing. Applicant may use an Official Entry Application form, which will be supplied by the Lighting Competition chairman upon request. (In any case where the applicant is unable to obtain an Official Entry Application form, he may send in his request to enter by letter).

RULE 2 — Any individual—who may be the owner or manager, or an employee of any of the following types of business — may enter the contest. These types of businesses, which are to be known as Contestant Divisions, are: electrical contractor; electrical wholesale distributor; architect or engineer; and electric utility. Either individual or joint entries may be made; joint entrants must specify which Contestant Division they are entering.

RULE 3 — Entries must be made in one of the following Installation Classifications: industrial lighting; store lighting; office lighting; institutional lighting; outdoor lighting; residential lighting.

RULE 4 — Contestants or their firms must have been responsible for either the design, layout, sale or installation of the lighting installation covered by each entry. The contestant will state this eligibility by describing in detail in each entry the part he took in the design, layout, sale or installation. In the case of joint entries, each contestant must state in the entry the work for which he was responsible.

RULE 5 — A contestant may submit any number of entries.

RULE 6 — Each entry must cover one or more of the following:

a. A lighting installation for a single specific visual requirement.

b. A lighting installation for a specific area, large or small.

c. An overall lighting installation for an entire building, project or general area.

A lighting installation using any make, or brand, or type of electric lighting equipment, and based on any lighting system design or layout, regardless of whether such lighting equipment, lighting system design or layout conforms with recognized standards for good lighting practice, may be entered in the Competition. The Board of Judges, however, will judge all entries based on those factors conforming with recognized standards of good lighting practice.

RULE 7 — Each entry must be submitted separately, in an official Competition Entry folder bearing an official Registration Number as assigned by the Competition chairman.

RULE 8 — All entries, to be eligible in the Competition:

a. Must be mailed on or before the closing date of the Competition (October 25, 1957), and must be received by the Competition chairman on or before November 4, 1957.

b. Must cover lighting installations completed within the period between January 1, 1956 and October 25, 1957.

RULE 9 — In submitting an entry, the contestant agrees to be bound by all rules of the Competition, and to abide by the decision of the Board of Judges, which will be final. All entries become the property of the sponsors of the 1957 International Lighting Competition, and no entry will be returned. All entrants, by submitting entries, further agree to grant the sponsors full reproduction and publication rights.

MAIL THIS COUPON FOR RULES AND ENTRY FORMS:

Berlon C. Cooper, Chairman
1957 International Lighting Competition
330 West 42nd Street
New York 36, N. Y.

Please send me the rules brochure and ____ entry forms for the 1957 International Lighting Competition.

Name _____

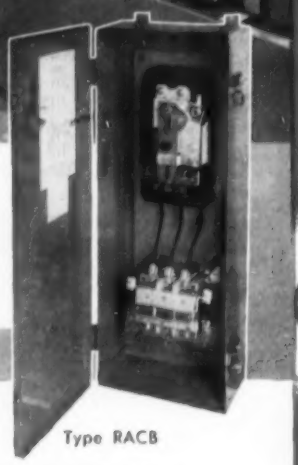
Company _____

Address _____

City _____ Zone ____ State _____

YOU can count on ARROW•HART for ON-THE-JOB HELP

Arrow-Hart Type RACB Combination Starters At The Connecticut By-Products Company, Columbia, Connecticut



Type RACB

PROBLEM: To provide the best method of one-point control for electrically operated production equipment in a new plant . . . and to answer perplexing installation wiring questions.

The Arrow-Hart Distributor, Beacon Light & Supply Company, Hartford, Conn., called for ARROW-HART SALES ENGINEERING SERVICE. THE NEAREST ARROW-HART SALES ENGINEER PROMPTLY WENT DIRECT TO THE JOB.

SOLUTION: The A-H Sales Engineer analyzed the requirements and recommended Arrow-Hart Type RACB Combination Starters to save space and assure easy, fast installation and economical operation. Type TRA Reduced Voltage Starters were used to protect against line disturbances.

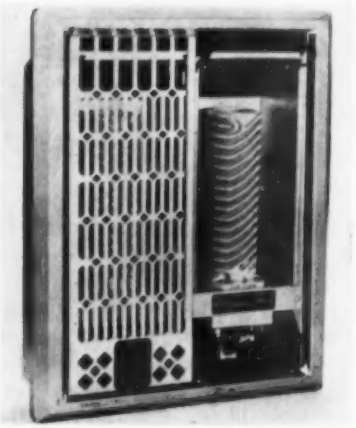
Equally effective on-the-job assistance is offered to all Arrow-Hart Distributors, Electrical Contractors and Plant Engineers confronted with perplexing problems. Simply write Dept. ECM, The Arrow-Hart & Hegeman Electric Company, 103 Hawthorn Street, Hartford 6, Connecticut, for complete information on ARROW-HART SALES ENGINEERING SERVICE.

ARROW AH HART

Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES

ARROW AH HART



Electric Heater (16)

A new line of smaller wall model electric heaters for homes, apartments, schools, and offices. Nine flush-mounted home heating units, rated from 1000 to 6000 watts, operate on 240-volt ac. Height of wall opening required to install the heaters has been reduced from 20¼ in. to 18¼ in. Width of opening, reduced by ½ in., varies from 9½ to 27¾ in. The 3¾ in. wall depth is unchanged. Heaters normally heat by radiation and convection. Where convected heat alone is desired, an aluminum baffle blocks out infrared rays. A bi-metal thermostat automatically maintains the desired temperature in any room. All models are finished in gray baked enamel with an aluminum grille.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

Time Switches (17)

Three new time switches handle short interval operations on 24-hour schedule. The V27000 "Supervisor Deluxe" series is designed for controlling operation of 5- or 15-minute intervals. This series is recommended for intermittent 24-hour control of recorded music, process timings, fans, and ventilating systems. Switches are available for 5- or 15-minute settings to control one or two circuits. Timing ranges of two to 60 seconds with a maximum of 288 operations per day are provided with the Series

V28000 and V29000 "Schedulers." They are recommended for maintaining operational schedules in schools, factories, and institutions; for controlling bells, signal lights, and buzzers; and for chemical and food processing. All switch ratings are 5 amps at 110 or 220 volts. Steel housings measure 9 by 4⅞ by 12¼ in. or 7 by 4⅞ by 8½ in. Other features include: signal test button; toggle switch control; synchronous, industrial-type motor; and four convenient knockouts in case. Bulletin NR-17 is available.

International Register Co., 2624 W. Washington Blvd., Chicago 12, Ill.

Instrument (18)

New snap-around type volt-ammeter, the RS-1 Amprobe, with its built-in recessed range-selector permits selection of any one of 4 amp and two voltage ranges by a flick of the thumb. Features include—a magnifying-glass covered dial; a longer needle sweep; a pointer-lock to lock needle in place when taking a reading in a difficult location. RS-1 can be used for current measurement without cutting conductors. Comes equipped with a fitted leather case.

Pyramid Instrument Corp., Lynbrook, N. Y.

Clock Hanger Outlet (19)

A new all-bakelite, one-piece clock hanger outlet, features an oversize recess 2½ in. by 1½ in. by 1 in. to take not only a large size cap, but also to provide storage of the coiled cord. Available in both brown and ivory. The non-corroding metal hook is locked into position and cannot twist; the receptacle unit provides easy side wiring and has heavy duty terminal and binding screws. Listed by both UL and CSA. Catalog sheet No. 2-56-10 is available.

Royal Electric Corp., Pawtucket, R. I.

NEW

ARROW AH HART

DUPLEX *Weatherproof* GROUNDING RECEPTACLES

5262WP

OPENED

CLOSED

Listed as Standard by Underwriters' Laboratories

ALSO *20* DIFFERENT OTHER DUPLEX RECEPTACLES

When installation exposes receptacles to weather, moisture, etc., Arrow-Hart's line of duplex receptacles fill the need . . . up to 20 types with unique weatherproof plates. Plate is cast aluminum with spring lift-lid cover. A rubber gasket seals cover when closed; rubber mat under plate makes weatherproof seal between box opening and building wall. Write for data to The Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn.

HART-LOCK INTERLOCKING TYPE

XT-7580-WP

COMBINATION DUPLEX GROUNDING TYPE

5290-WP

XT-7540 WP

SPECIFICATION GRADE, TWO-WIRE TYPE

1913-WP

400-WP

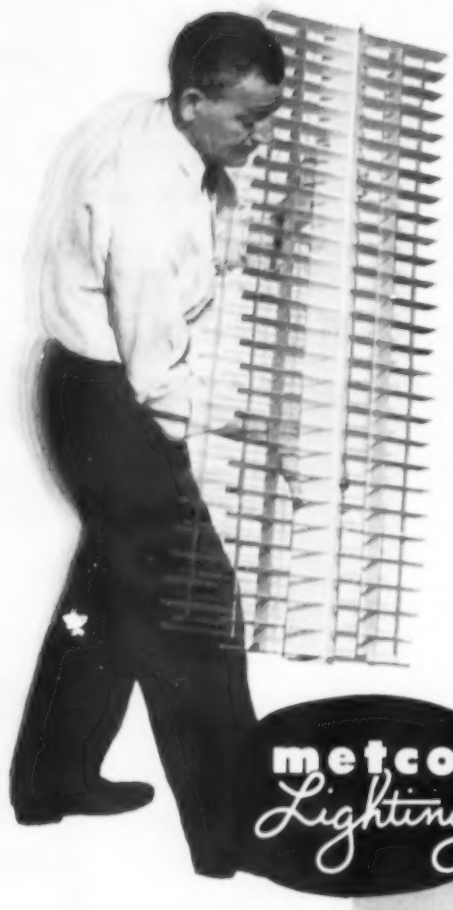
ARROW AH HART

Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES

ARROW AH HART

give AstraLITE the
SHAKE-RATTLE test



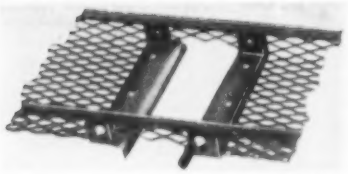
There's not a rattle in a carload of the louvers with which new METCO ASTRA-LITE luminaires are shielded. Projection-welding bonds every joint, holding each louver blade in rigid, permanent alignment. Projection-welding is one of many advanced manufacturing techniques and design advantages used in this popularly-priced, multi-purpose luminaire series. Write today for an ASTRA-LITE catalog sheet.

metco Lighting

FIRST CHOICE FOR
ONE OF PHILA.'S LARGEST
SCHOOL LIGHTING JOBS
New Cardinal Dougherty
High School

Architects and Consulting Engineers:
Stickle & Associates
Electrical Contractor: H. B. Frazer & Co., Inc.

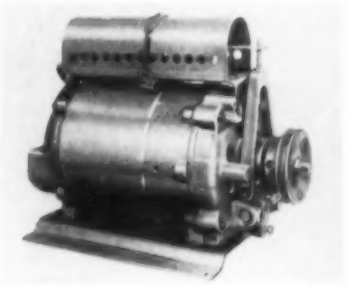
Sold only through qualified electrical distributors
METALCRAFT PRODUCTS COMPANY, INC.
Mascher and Lippincott Streets, Philadelphia 33, Pa.



Fitting **(20)**

A new fitting to accompany the Cope cable trough system for the support of power and control cables. It permits cables to be dropped out at any point in the run to connect with motors, etc. Made from expanded steel mesh. Rounded metal strips are bolted to edges of trough to protect cable insulation. Side supports are also provided. Available in five standard widths from 6 in. to 24 in. and the drop-out is offered for all widths.

T. J. Cope, Inc., Third & Walnut Sts., Collegeville, Pa.



Transmitter **(21)**

Rapid stop-start machine operation can be remotely or automatically controlled with a solenoid operated power transmitter. Motor uses a constantly running motor-driven fly wheel with a short throw clutch. Control is accomplished by a stop-start push-button station or can be automatic through the use of limit switches, sensing devices, timers or other controls used in automated plants. Power transmitter, designated Type "J", is a totally enclosed, fan-cooled unit with pre-lubricated ball bearings. It is available for single-phase, 60-cycle, 115/230-volt operation in ¼, ½, ¾ and 1 hp ratings and for 2- or 3-phase, 60 cycles, 208-, 220/440- or 550-volt operation. Ratings of 2- and 3-phase models are from ¼ to 2 hp.

Diehl Manufacturing Co., Somerville, N. J.

Motor **(22)**

A new weather-protected motor (Type FOD) for non-hazardous outdoor installations. Available in ratings of 250 hp and larger, the motor is built into a fabricated steel frame equipped with two removable air ducts. Capsule mounted sleeve bearings are supported by cast iron bear-

ing brackets which close the end of the frame. Frame houses a removable pre-wound stator assembly unit. Stator leads, completely enclosed and protected, are brought to a diagonally split cast iron conduit box. Air intake ducts are equipped with protective screens above the intake openings. Cartridge-mounted, anti-friction bearings are available on all ratings at speeds of 1800 rpm and slower. Immersion type space heaters for use during periods when a machine is inactive are standard equipment.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Solderless Wiring Device (23)

Two general types of terminals and connectors known as the Krimptite and Insultite. Krimptite are functionally designed to make uniformly, reliable connections. Insultite incorporate all of the advanced features of Krimptite construction plus the advantages of permanently attached plastic insulating sleeve. Sleeves are made in colors of red, blue and yellow to code-identify the various wire sizes. All terminals and connectors are rated beyond the current carrying capacity of the wires used. They are available in ring, spade, hook tongue; snap-plugs and flag-type, parallel, butt, 3-way "Y", 4-way "X" connectors to fit wire ranges of 22-16, 16-14 and 12-10.

Electric Terminals Corp., 2021 Center St., Cleveland 13, Ohio

Floodlight (24)

A new floodlight unit designed for areas subject to moisture or moisture vapor. Designated as SFL-38 floodlight, it is a sealed beam fixture fabricated from die-cast aluminum. It is completely weatherproof in any position, and adjustable in any direction or angle. Furnished complete with medium base socket and long wire leads, it will take PAR-38 and R-40 medium base spot and flood lamps. Fixture is supplied with a special heat-resistant rubber gasket.

Killark Electric Mfg. Co., Vandeventer and Easton, St. Louis 13, Mo.

PORTABLE POWER THREADING

Ready to go-- wherever you go

TOLEDO No. 78 Power Drive—
with wrenchless chuck, forward and reverse rotation, ¼ to 2" capacity — a real work-saver.
TOLEDO Drop Head Ratchet Threader—
die change in a jiffy, ⅛ to 2" sizes, light, convenient for close corner work, replaceable dies.
VERMETTE POWER DRIVE

Take the toil out of threading . . . this chuck locks pipe or conduit in place—with one finger tightening. Just put the pipe in the wrenchless chuck, "finger" tighten, turn the switch and you're ready to go. Team the No. 78 with a TOLEDO Drop Head Threader and your threading jobs are turned out in seconds. See these TOLEDO-quality products at your supplier's today! Send for complete information.

BUILDERS OF THE WORLD'S FINEST PIPE TOOLS

TOLEDO

PIPE THREADERS • PIPE WRENCHES • PIPE MACHINES

THREADED PIPE

THE TOLEDO PIPE THREADING MACHINE CO. • TOLEDO 4, OHIO

New BLACKHAWK ALUMINUM "1-bite" benders slash bending costs 77%

Now your own men can easily make factory-like bends while you enjoy BIG SAVINGS!

Super-portable Blackhawk electric-powered hydraulic pipe benders *save up to 77%* compared to cost of manufactured ells! Pay for themselves in just 35 bends.

BLACKHAWK offers benders in ALL price and size ranges to meet every bending need!

NINE complete Blackhawk bending sets handle 1 ¼" - 2" diameters thin-wall conduit — ½" - 4" diameters rigid conduit and pipe. Your choice of either lightweight rugged steel or new, featherweight aluminum construction.

MODEL	PUMP	DIAMETERS	PRICE
S-30A	Hyd. hand pump	1, 1¼, 1½, and 2" rigid conduit and pipe	$151.50
S-34	Hyd. hand pump	1¼, 1½, 2" thin-wall conduit	253.50
S-36	Hyd. hand pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe	330.00
New S-130 1-bite	Hyd. hand pump	½ - 2" rigid conduit and pipe	199.00
New S-132 1-bite	Electric-powered pump	½ - 2" rigid conduit and pipe	496.50
New S-137 1-bite	Hyd. hand pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe	565.00
New S-138 1-bite	Hyd. hand pump	1¼, 1½, 2, 2½, 3" rigid conduit and pipe	474.50
New S-139 1-bite	Electric-powered pump	1¼, 1½, 2, 2½, 3" rigid conduit and pipe	730.00
New S-140 1-bite	Electric-powered pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe	820.00

call your electrical or industrial supply house now!

BLACKHAWK

BLACKHAWK MFG. CO., Dept. P-2037, Milwaukee 46, Wisconsin

Hydraulic pipe benders

Hydraulic Knock-Out punches

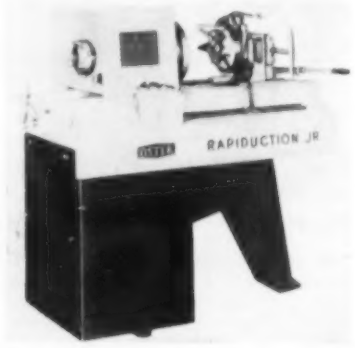
Hydraulic jacks 1½ to 100-tons

BLACKHAWK bends prove BLACKHAWK'S best!

Door-Operator Motors (25)

A complete line of instantly reversible door-operator motors specially insulated to resist moist-air conditions for commercial, industrial, and domestic applications. Instantly reversible and reversing-from-standstill models are included in the line of Form G motors. At 1725 rpm, ratings from 1/6- through ¾ hp provide power for door types ranging from light-duty domestic garage doors through heavy-duty commercial and industrial doors. Designed for operation in any position, motor has all-angle sleeve bearings and a lubrication system that prevents oil loss even when mounted vertically. Motor can be rotated in its base to meet mounting requirements. Resilient mountings are also available. Motors are available in either instantly reversing or reversing-from-standstill models, with 3- or 5-lead design in the instantly reversing models and with 4-lead standard and 3-lead balanced-winding designs in models which reverse from standstill.

General Electric Co., Schenectady 5, N. Y.



Threading Machine (26)

A new line of threading machines, known as the "Rapiduction Jr." This line is comprised of four machines of the same basic design but with different types of die-heads and workholders. Model No. 792, primarily a pipe threading machine of ½-in. to 2-in. capacity, will also thread bolts

and rods from ¼-in. to 2-in. diameter. Types of die-heads are offered, one using hobbed, radial type dies and the other tangential type dies. A new type gripping chuck known as the "Power-Matic" is standard equipment on No. 792. Model No. 792-R, equipped with a manually operated revolving, radial-type die-head and open-type vise which hold work stationary, is available for jobs where it is necessary to thread pipe, rods or bolts after bending. Two other models, Nos. 719-A and 792-A, are primarily bolt and rod threading machines and are designed with semi-automatic, revolving die-heads of the radial type. Drive motors are 3 hp, 1800 rpm with 4-speed transmissions.

Oster Manufacturing Co., E. 289th and Nickel Plate R.R., Wickliffe, Ohio

Generator (27)

Two 1,500-watt portable electric generators featuring a vertical shaft design. Powered by gasoline engines, the two models—EG-1.5A for ac and EG-1.5D for dc—provide 13 amps of 115-volt current for operation of electric drills, saws, hammers, concrete vibrators and other tools on construction sites. Each has a 4-cycle, single cylinder, air-cooled engine with automatic rewind starter. A toggle type ignition switch eliminates shock danger and inconvenience of shorting straps. Two plug-in outlets are provided, and any number of tools or lights with a total power requirement up to 1,500 watts may be used simultaneously.

Thor Power Tool Company, Chicago, Ill.

Colored Fixtures (28)

Colored fluorescent fixtures designed to blend with interior decorating schemes. First colors to be marketed in its new "Carousel" line will be sea mist green and sun tan brown. Fixtures bearing these colors will be of the ceiling or suspension-mounted types. Brackets for fixture can be painted in similar colors.

Westinghouse Electric Corp., Pittsburgh, Pa.

DOSSON "F" SPLIT BOLT CONNECTOR

Fabricated from high strength alloys (better than average steels), the Dosson "F" is cold-formed for uniform quality. Maximum contact pressure is assured by a high translation of tightening torque. Full length pressure bars with rounded edges prevent load concentration and crushing of conductor. Built to withstand high overload, vibration. Highly corrosion resistant.

Mail coupon for FREE Dosson "F" Connector

UL LISTED UNDER RE-EXAMINATION SERVICE UNDERWRITERS' LABORATORIES, INC.

DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.

Gentlemen:
Please rush free sample Dosson "F" Split Bolt Connector plus catalog sheet.

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PRODUCT SELECTOR

with Application and Installation Data . . .

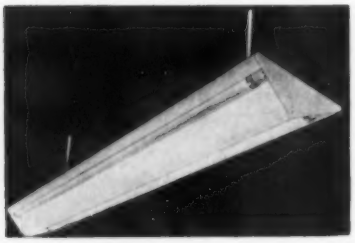
This 36-page book is crammed full of just the kind of information you need to save time, effort, and money on residential, commercial, and industrial wiring jobs.

Besides providing complete buying information on the more than a thousand separate items in Clark's American line of utility service products, it shows rough-in dimensions, load-carrying capacities and other pertinent application and installation data.

In addition, it contains: a complete section devoted to engineering data such as wire and conduit capacities; formulae for determining amperes, horsepower, Kilowatts and KVA; ampere ratings of AC and DC motors; appliance load requirements; etc., etc.

This book will be a valuable reference source in your files. Write for your copy today.

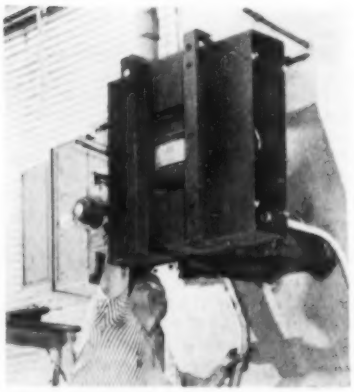
American
ELECTRIC SWITCH DIVISION
The CLARK CONTROLLER Company
Engineered Electrical Control • 1146 East 152nd Street • Cleveland 10, Ohio



Lighting Fixture (29)

A lighting fixture for schools, known as PHI/BETE, utilizing the new fluorescent reflector lamps. 75% of light is directly distributed upward, and 25% is diffused downward. Cross section of body design is a shallow inverted triangle flanked on each side by reflector lamps and with braced longitudinal deflectors to shield the upward component. Fixture is made of steel and cast aluminum and finished in baked white enamel. Option of body colored in choice of red, blue, yellow or matching color instead of standard white. Fixture is designed only for suspension mounting and for reflector fluorescent or slimline lamps. Available in 2- and 4-lamp slimline models, 48 or 96 in. in length; and will be available later for two or four 48-in. rapid start lamps.

Peerless Electric Co., 576 Folsom St., San Francisco, Calif.



Transformers (30)

New Type M transformer ratings through 50 kva single-phase and 150 kva 3-phase to meet low noise level requirements in commercial buildings such as hospitals, motels, shopping centers, libraries, and offices. The line is dust proof, drip proof, and of fire resistant construction. They are designed for a noise level of approximately 45 decibels or below. Transformers are designed to meet increased electrical load requirements in commercial buildings. Suitable for indoor and outdoor applications. The line is available in 25, 37½ and 50 kva single-phase and 30, 45, 75, 112.5 and 150 3-phase ratings. Listed by UL.

General Electric Co., Schenectady 5, N. Y.

Tool (31)

A new power-actuated stud driver, designed specifically for small home builders and installation contractors. The "Mighty-Mite" model 456 is constructed of three parts and weighs 3¾ lbs. After a stud with "Power-Guide" disc attached has been placed in the barrel, the operator inserts a 2-caliber power load. When he twists and depresses the tool against the work surface, the firing pin is exposed at the top. A light, sharp hammer-blow against the pin fires the tool. The 22-caliber power load sends the nail-like stud into the work surface to complete the fastening. It features built-in safety. It must be held perpendicular to work surface, twisted and depressed against work before it will operate.

Remington Arms Company, Inc., Bridgeport, Conn.

Bracket (32)

When ice drops from a neutral conductor in a single-phase REA-type system, the conductor sometimes flips into the phase wire, causing the phase and neutral conductors to burn. To prevent this, a new offset neutral wire bracket that holds the neutral conductor away from the pole, in a different vertical plane than the phase wire has been developed. The bracket is fastened to a pole by means of a shoulder, square nut and locknut, and is supported by a U-style brace, welded to the horizontal member for greater rigidity and permanent position. Brace is attached to pole by ½-in. lag screws. Total extension from pole surface is 16½ in. No. 4473 is for poles with 6-in. to 8½-in. diameters and No. 4474 for poles with 8½-in. to 12½-in. diameters. Standard spool-type insulators, No. 355 dry or No. 455 wet, are used.

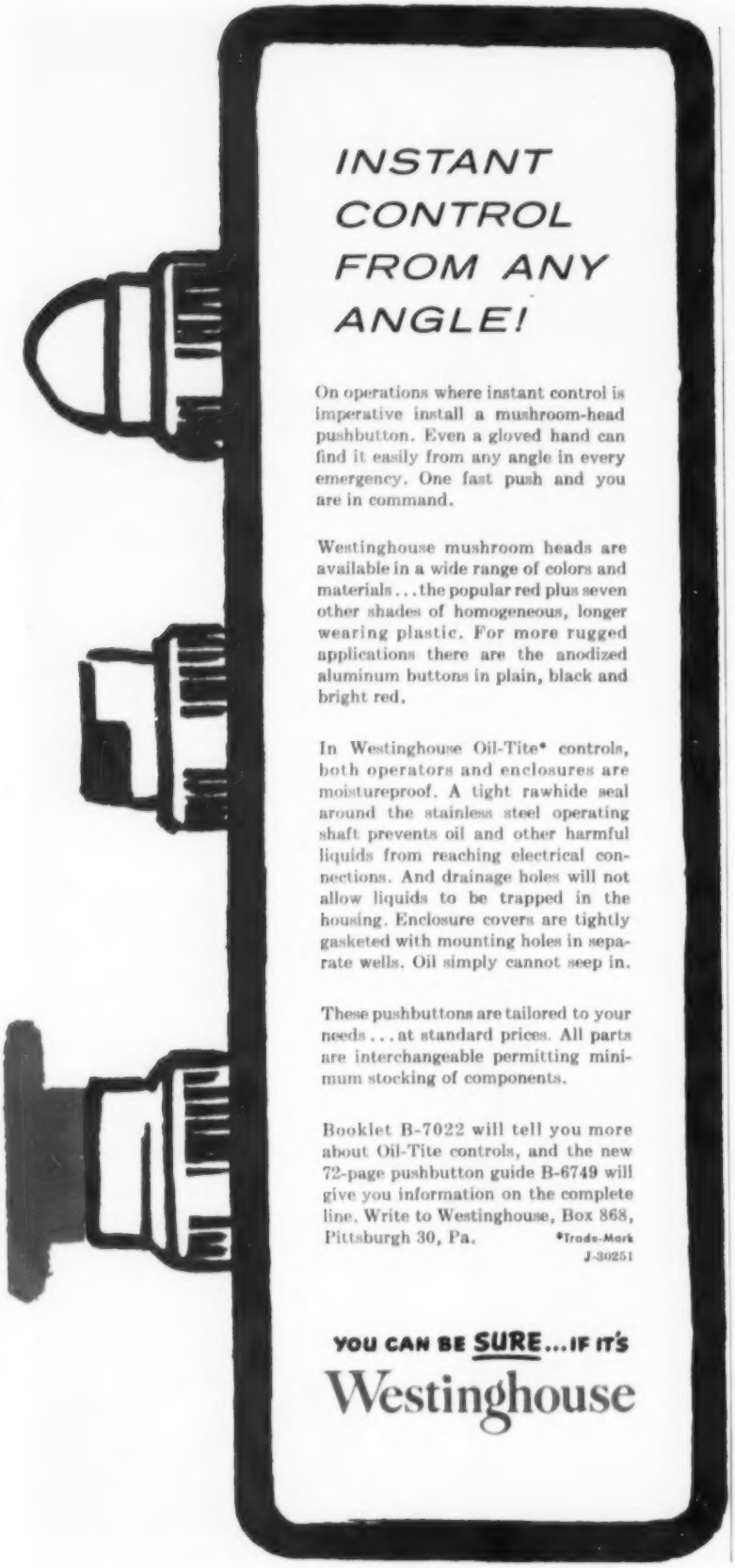
Hubbard and Company, 6301 Butler St., Pittsburgh 1, Pa.

Rectifier (33)

A new power rectifier, utilizing either germanium or silicon semi-conductors, designed specifically for paper mills manufacturing their own chlorine. Features are water-cooled heat exchanger; Sel-Rex Gard-a-matic overload protector, consisting of a specially designed auxiliary circuitry which prevents damage to rectifier in event of an overload; and hermetically sealed germanium or silicon cells.

Sel-Rex Corporation, Newark, N. J.

Here's the fastest way to make conduit installations, where less than standard lengths are used. Insert conduit into an Efcor "No-thread" connector or coupling and tighten the nut ...no need to cut threads! For angle connections—eliminate threading *and* bending, with 45° and 90° "No-threads." The time and labor saved by "No-threads" ...cuts costs for contractors! Because "No-threads" eliminate need for threading and bending tools, plant maintenance men will find a stock of Efcor "No-threads" indispensable. For "No-threads" types and sizes you need—your most complete source is Efcor! Sold exclusively through electrical wholesalers.
Efcor "No-thread" folder on request
eliminate threading and bending of conduit with
EFCOR NO-THREAD CONNECTORS
Efcor
Reg. Trade Mark
for all your fitting needs... the full line is EFCOR!
straight
45
90
coupling
ELECTRICAL FITTINGS CORPORATION, 37-50 57th STREET, WOODSIDE 77, L. I., N. Y.



INSTANT CONTROL FROM ANY ANGLE!

On operations where instant control is imperative install a mushroom-head pushbutton. Even a gloved hand can find it easily from any angle in every emergency. One fast push and you are in command.

Westinghouse mushroom heads are available in a wide range of colors and materials . . . the popular red plus seven other shades of homogeneous, longer wearing plastic. For more rugged applications there are the anodized aluminum buttons in plain, black and bright red.

In Westinghouse Oil-Tite* controls, both operators and enclosures are moistureproof. A tight rawhide seal around the stainless steel operating shaft prevents oil and other harmful liquids from reaching electrical connections. And drainage holes will not allow liquids to be trapped in the housing. Enclosure covers are tightly gasketed with mounting holes in separate wells. Oil simply cannot seep in.

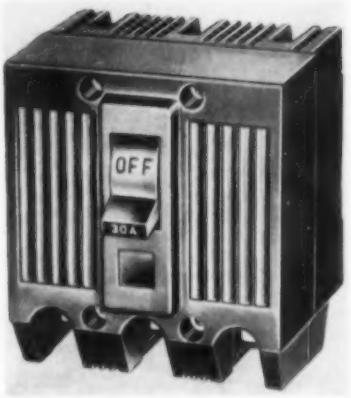
These pushbuttons are tailored to your needs . . . at standard prices. All parts are interchangeable permitting minimum stocking of components.

Booklet B-7022 will tell you more about Oil-Tite controls, and the new 72-page pushbutton guide B-6749 will give you information on the complete line. Write to Westinghouse, Box 868, Pittsburgh 30, Pa. *Trade-Mark

J-30251

YOU CAN BE SURE...IF IT'S

Westinghouse



Circuit Breakers (34)

New 240-volt plug-in circuit breakers, half the size of the conventional E-frame, are now available for applications on lighting and power circuits from 15 to 50 amps. The new TQL breakers plug into all G-E 3-phase service entrance load centers and lighting panelboards. New lines of associated TQLP plug-in power panelboards and separate individual enclosures have been developed. The line has 1-, 2- and 3- pole devices, 15-50 amps, for 120- 120/240- and 240-volt ac applications. Switching neutral and isolated terminal plug-in breakers complete this line.

Circuit Protective Devices Dept., General Electric Co., Plainville, Conn.

Mounting Plates (35)

The MIF line of transformer mounting plates for direct pole mounting of 75 kva and 100 kva single-phase and 75 kva and 112½ kva 3-phase EEI-NEMA standard transformers; also for older style transformers where lug spacings match the slots in these plates. Feature of basic design of plates are: broad wing design with long horizontal lug slots; channel back; extra long vertical slots; serrated reinforcing ribs. All plates are one-piece malleable iron castings with integral reinforcing ribs at points of high stress, and all are hot dip galvanized. Some types can be mounted on 4-in. wide horizontal or 3-in. wide vertical steel

members, as well as on motor cluster mounting brackets. Plates can be attached to transformers in store room, work area or field and no special tools are required.

Malleable Iron Fittings Company, Branford, Conn.

Lighting Fixture (36)

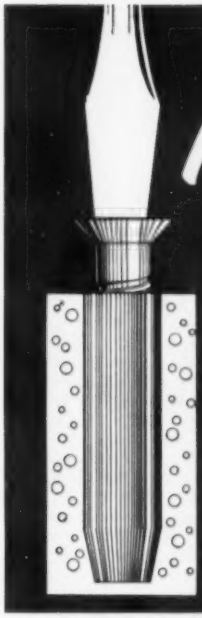
The Ultra-Lux is a shallow surface mounted fluorescent fixture for low ceiling construction. It is 3¼ in. deep. Unit is curved in profile and seems to recede into the ceiling. Its translucent polystyrene shield permits efficient light transmission with uniform distribution and surface brightness—within acceptable limits for glare-free comfort in office or classroom. Units may be joined in continuous runs. Concealed hinges simplify cleaning and relamping.

Garden City Plating and Manufacturing Co., 1750 N. Ashland Ave., Chicago 22, Ill.

Earth Boring Machines (37)

Redesigning and incorporation of the latest high-torque Ingersoll-Rand multi-vane air motors, have increased boring speeds of the Hydrauger horizontal earth boring machines by 40%. The Hydrauger principle of operation is classed as wet hole boring. The straight, open hole allows the installation of many kinds of pipe. Machines are available in several new sizes and modifications. The larger machines bore holes of 2 through 24 in. in diameter for distances up to 250 ft. Literature is available.

Hydrauger Corp., Ltd., 681 Market St., San Francisco 5, Calif.



IN TO STAY!

The Modern Anchor for Screws and Nails

HI PLASTIC ANCHORS

- TREMENDOUS HOLDING POWER . . . "Use in Any Material You Can Drill"—concrete, cinder block, tile, brick, mortar, metal, etc.
- Cut anchoring costs up to 70%.
- Sizes for No. 4 screw up to ½" lag screw . . . Buy 'em by the Carton or in handy Plastic Kits.

LOW COST! LIFE-TIME ANCHOR! MILLIONS IN USE!

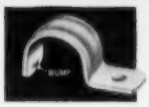
Hi 600-V CONNECTORS

"SCREW-ON" TYPE

Hi-4 and Hi-6 Bakelite Connectors—pressure cable connectors for general use in all types of Branch Circuit and Fixture wiring.

APPROVED FOR 600-V USE

Hi "SNAP-ON" STRAPS



TIMESAVERS... Just "snap-on"—they hold tight leaving both hands free for installing rigid or thinwall conduit . . . Makes difficult and conventional installations easier. Precision made of heavy gauge steel, zinc coated. Sizes from ⅜" to 2".

Hi REAM-RITE

BEVELS, DE-BURRS & REAMS END OF E.M.T.

Use on all sizes of Thinwall conduit or Greenfield—½" up. Fast action, simple to use. Just insert one blade . . . turn once to right, and back to left. That's all! Pays for itself through the fittings it saves!

Hi "TAPE-MATE"

FISH TAPE WINDER

IT'S NEW! Attaches to Fish Tape Reel . . . protects your hands . . . slides around reel. Push to wind . . . pull to pay out tape. Eliminates kinks and broken tape.

"Hi SPEED" WIRE STRIPPER

Fully Automatic

Delayed return action prevents crushing of fine stranded or solid wire. Single squeeze operation . . . easy grip, razor sharp adjustable blades.

STRIPS FASTER, CLEANER, BETTER!

Hi CABLE RIPPER

SAFE! FAST!

FOR NON-METALLIC SHEATHED CABLE, including type "T."

Edges of handles are smooth . . . case-hardened cutting point . . . cuts clean and quick in one operation.

MAIL COUPON FOR 1957 "Hi" CATALOG

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

Hi TRADE MARK REG.

HOLUB INDUSTRIES, Inc.

442 ELM STREET • SYCAMORE, ILLINOIS

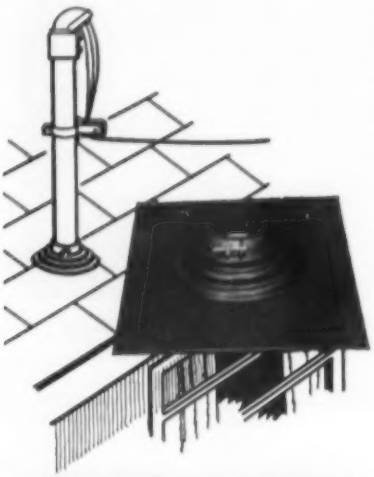
Blackhawk Service Entrance Masts with

REVOLUTIONARY NEW

NEOPRENE

roof flashing units

--VIBRATION ABSORBING, WEATHERPROOF



Now, the entire roof flashing unit of Blackhawk Service Entrance masts is made of vibration absorbing, weatherproof Neoprene. When the mast begins to vibrate from high winds or cable sway, the Neoprene "gives" slightly. In this way, vibrations are absorbed in the upper collar and bulge area of the roof flashing unit. Vibrations do not cause strain on the unit base and therefore there's no strain on the roof.

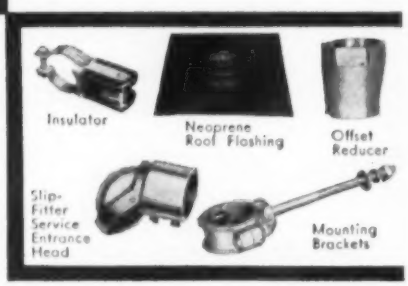
Blackhawk's Neoprene unit is weathertight and weatherproof. Withstands hot sun, driving rains, freezing cold without cracking, peeling or rotting.

To install the unit, simply slip it on over the pipe and push it down to the roof. An adjustable metal clamp seals the collar to the mast providing a completely weather tight fitting. Shingles fit over it easily, providing a neat installation. Neoprene roof flashing units are available for 2" and 2½" pipe.

Topping off the Blackhawk service entrance mast is the Slip-fitter service entrance head. The slip-fitter head slips over the conduit . . . needs no threads . . . no extra clamping devices. Just tighten the two set screws and the head is firmly in place. Blackhawk service entrance heads are available in 2" and 2½" slip fit units with 1¼" service entrance cap.

Blackhawk's sturdy pipe mounting brackets, attached to vertical studding of the house, support the *entire* service drop strain. Thus eliminating weight and vibration strain from rafters and roof.

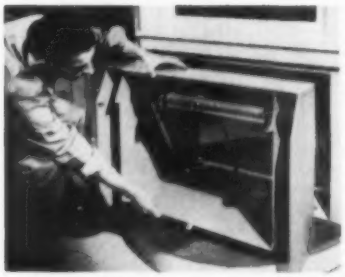
Blackhawk service entrance masts, with slip-fitter head and new Neoprene roof flashing, can be sold as a complete kit or as separate fittings.



Blackhawk Industries

BLACKHAWK INDUSTRIES

DUBUQUE, IOWA



Air Conditioner **(38)**

A dual-purpose room air conditioner—a flush-fitting, wall-mounted unit that cools in the summer and heats like a steam or hot water radiator in the winter. Unit contains a heat convector that connects to steam or hot water pipes. Unit is 31 in. wide and was designed to fit under a window. Along its top front is a sloping control panel. To install, only the sleeve or casing is placed in the wall. The removable mechanism then slides drawer-like into the casing. It fits flush on the outside wall and projects 4 in. into the room. It is available in ¾ or 1 hp capacities. Also available in a model which operates on 115 volts, eliminating the need for special 230-volt circuits. Where high-voltage circuits already are installed, a 230-volt model is available.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

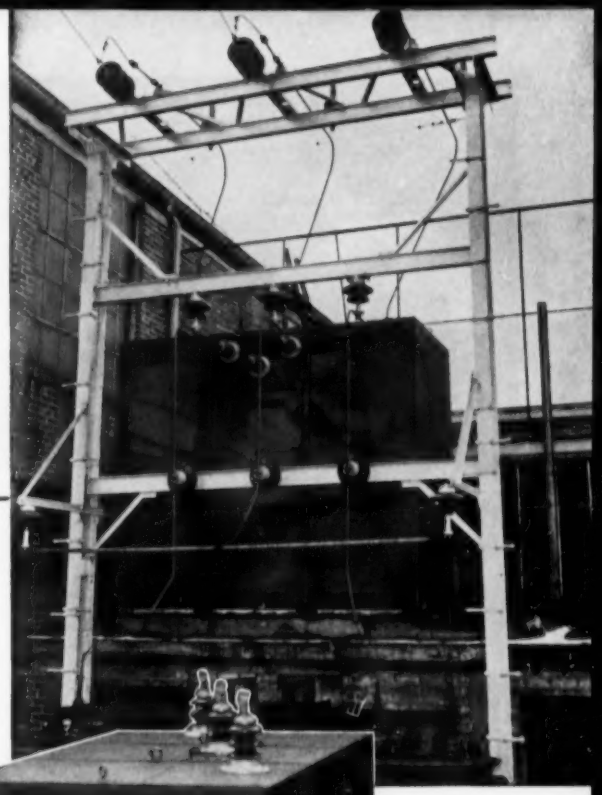
Intercom System **(39)**

Intercommunication system which permits privacy on calls between any two master stations, employs a single pair of wires for annunciator and voice. Known as "NOR" Kwik-Kall intercom system, it introduces a low-cost method of multiple-station intercommunication. Annunciators afford both visual and audible indication, detectable at receiver station by chime or bell, and by a signal plunger which is activated into position and remains as a "memo" message on the receiving station if not answered. "NOR" includes both speaker and handset. Speaker disconnects when handset is lifted. One-pair wire secret master station may include paging and/or secret two-way communication by including a public address paging key. A common ground is used throughout the circuit for ringing.

J. M. Loge Sound Engineers, 2171 West Washington Blvd., Los Angeles, Calif.

How S&C "JOB MATCHED" Metalclad Switchgear saved 50%

for Twin Disc Clutch



Typical high-voltage power supply systems for industrial plants are rarely exposed to faults, either transient or permanent. For that reason they can use the simple radial form of power distribution, and dispense with high-priced protective equipment that provides automatic reclosure against faults. Reliable interruption of permanent faults and occasional switching is all that is required; and this is provided by S&C Metalclad Switchgear.

The plans for doubling the high-voltage power system capacity at Twin Disc Clutch Company included S&C Metalclad Switchgear for the high-voltage switching center... the 3-unit assembly is shown. In addition to the substantial economies resulting from elimination of complex equipment, S&C gear saved valuable ground space normally required for an open structure.

Experienced S&C engineers will be glad to assist you in building economy into your high-voltage power supply.

Exum French, President, B. & F. Hi Line Construction Corp., Rockford, supervised the installation.

Specialists in High-Voltage Switchgear for Electric Utilities since 1910

S&C ELECTRIC COMPANY

4433 RAVENSWOOD AVENUE
CHICAGO 40, ILLINOIS, U. S. A.

In Canada:
S&C Electric Canada, Ltd., 8 Vansco Rd.
Toronto 14, Ontario

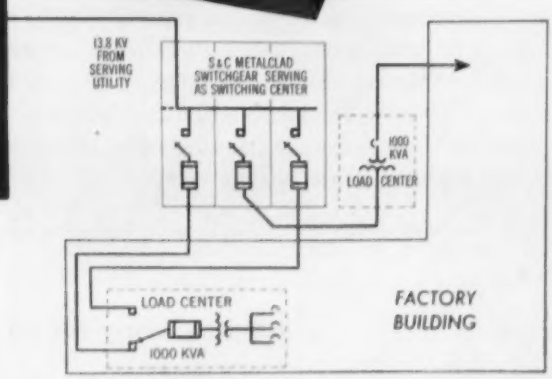
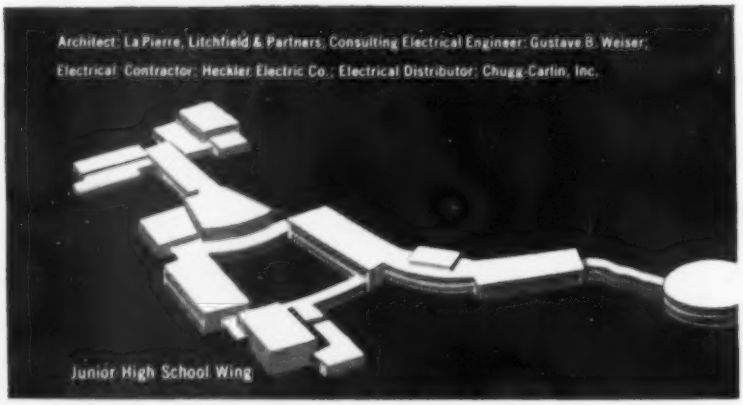


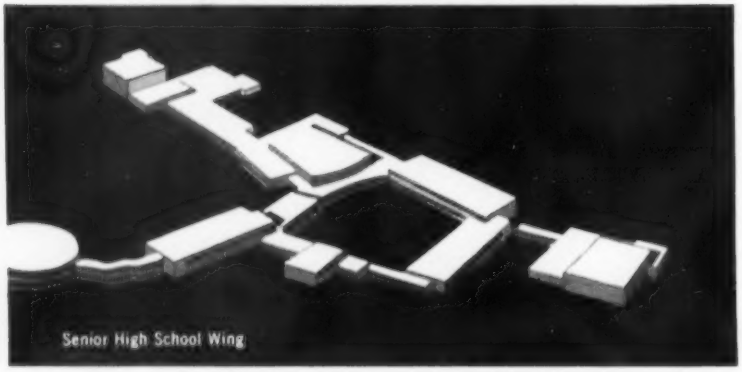
Diagram at right shows use of S&C Metalclad Switchgear in radial-type circuit at Twin Disc Clutch Company


Architect: La Pierre, Litchfield & Partners; Consulting Electrical Engineer: Gustave B. Weiser;
Electrical Contractor: Heckler Electric Co.; Electrical Distributor: Chugg-Carlin, Inc.
Junior High School Wing

lighting design by **mc Philben**

for the magnificent new Great Neck High School

. . . a wholly new concept in school architecture and quality building.



McPhilben 43-24 recessed weather-tight downlights will light the exterior corridors of this superb new school in Great Neck, N. Y. Only 3½ inches deep, the 43-24 housings are sturdily constructed of 16 gauge galvanized steel. The gleaming satin finish of the face plates will resist all corrosive elements, thanks to the anodized cast aluminum construction. And, mcPhilben's exclusive Sealume gasket of neoprene rubber will assure permanent weather-tight maintenance-free operation.
Your mcPhilben representative has full details about the 43-24 and other mcPhilben recessed weather-tight downlights, both square and round. Contact him or write to mcPhilben Lighting Co., 1333 Willoughby Avenue, Brooklyn 37, N. Y.

Representatives in major cities • Stocked by electrical wholesalers

Safety Switch (40)

A heavy duty industrial safety switch in a NEMA Type 12 oil- and dust-tight enclosure especially designed for applications where heavy concentrations of dust, lint, oil, or coolant seepage are present. New enclosure design incorporates heavy duty Style HCI single-throw, double-break fusible or no-fuse switch mechanism. It meets JIC standards and NEMA HD standards and is available in ratings of 30 through 200 amps, 240 through 600 volts, 2- and 3-pole construction. Switch is listed with UL.

Circuit Protective Devices Dept., General Electric Co., Plainville, Conn.

Bender (41)

A new portable one-piece hand tool for bending 1-in. Sherarduct and other types of rigid steel conduit and 1¼-in. duct Junior metallic tubing, is the NE Benfield "Redege" bender with a "Powr Jack" booster step. Made of special analysis pearlitic malleable iron and finished in aluminum paint with red symbols for precision bending. Features include an integral back pusher groove to true up and straighten bends, a short radius arc for shallow slabs and narrow partitions, a safety collar for thread protection. The same groove is used for rigid conduit or electrical metallic tubing.

National Electric Products Corp., Gateway Center, Pittsburgh, Pa.

Lighting Fixtures (42)

Highlighting the new Moe Light outdoor lighting fixtures is a complete selection of wall brackets, ceiling lanterns and post lights, styled in either traditional or contemporary design. Many of these fixtures are available in polished brass, black on aluminum or antique solid copper. Also life-time aluminum posts, in either aluminum finish or black on aluminum. They come in adjustable, 72 to 84 in. or non-adjustable, 84 in. overall, size. Fixtures are made of weatherproof, non-corrosive materials.

Moe Light Division; Thomas Industries Inc., 410 South Third St., Louisville 2, Ky.

INSPECTORS welcome the *over-all* protection of these *full housepower* panels. All circuits are easy to identify. And *one* main disconnect for every 100 amps of service meets any code limitation.

BUILDERS find these nationally advertised panels pack real consumer appeal. It's easy to sell push-button convenience, maximum *over-all* electrical protection and full capacity to meet future needs.

HOME BUYERS get *full housepower*, safer electrical living and push-button convenience. They'll have *maximum* over-all electrical protection and be prepared for future electrical demands.

Everybody profits with new Pushmatic panels!

Main disconnects assure over-all electrical protection!

New Electri-Centers with main disconnects are good news for you *and* your customers. Now you can upgrade jobs . . . provide maximum over-all protection, convenience and full capacity to meet both present and future electrical needs. Factory-installed main disconnects require no field wiring. And trouble-free operation eliminates profit-consuming callbacks. What's more, these new, high-quality circuit-breaker panels compare in price with ordinary panels.

Check what they mean to your *customers*, too . . . and to *their* customers. That's where acceptance and sales begin. You'll see in a hurry that the new Pushmatic Electri-Centers® are loaded with advantages—for *everyone!* Get the complete story from your BullDog distributor or field engineer.

© BEPCO

BullDog Electric Products Company, Detroit 32, Michigan • A Division of I-T-E Circuit Breaker Company • *Export Division:* 13 East 40th St., New York 16, N.Y. *In Canada:* BullDog Electric Products Company (Canada), Ltd., 80 Clayson Rd., Toronto 15, Ontario.

IF IT'S NEW . . . IF IT'S DIFFERENT . . . IF IT'S BETTER . . . IT'S

BULLDOG

ELECTRIC PRODUCTS COMPANY

A DIVISION OF I-T-E CIRCUIT BREAKER COMPANY

"HOLD DINNER...

I'VE GOT ONE MORE

He's your electrical distributor's salesman.
A customer calls, just about "quitting time."
So the salesman phones home: hold dinner.

"We need a 200 amp 3-pole SN fusible safety switch," the customer explains. "It's got to be type-A. We're stopped cold till we get one. How soon can you deliver?"

Right now, the salesman says. He delivers.

Pin a medal on him? No, that's his job – service.
He's there when you need him.

Your electrical distributor saves you money when he helps you avoid delays . . . Keep him in mind next time you order.

ELECTRICAL WHOLESALING

A McGRAW-HILL PUBLICATION ABP ABC

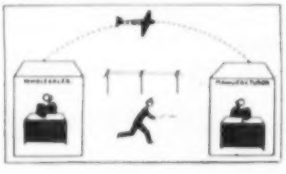
The only magazine devoted exclusively to the interests of the electrical wholesale distributor

---

Your electrical distributor offers you these services:

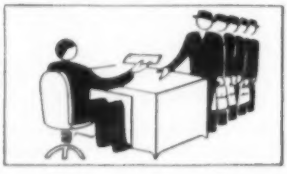
His hundreds of purchase orders keep a flow of thousands of different products rolling from manufacturers into his warehouse the year around.

By airmail, telegraph, telephone, the distributor keeps in touch with the many manufacturers whose lines he stocks, to expedite his shipments to you.

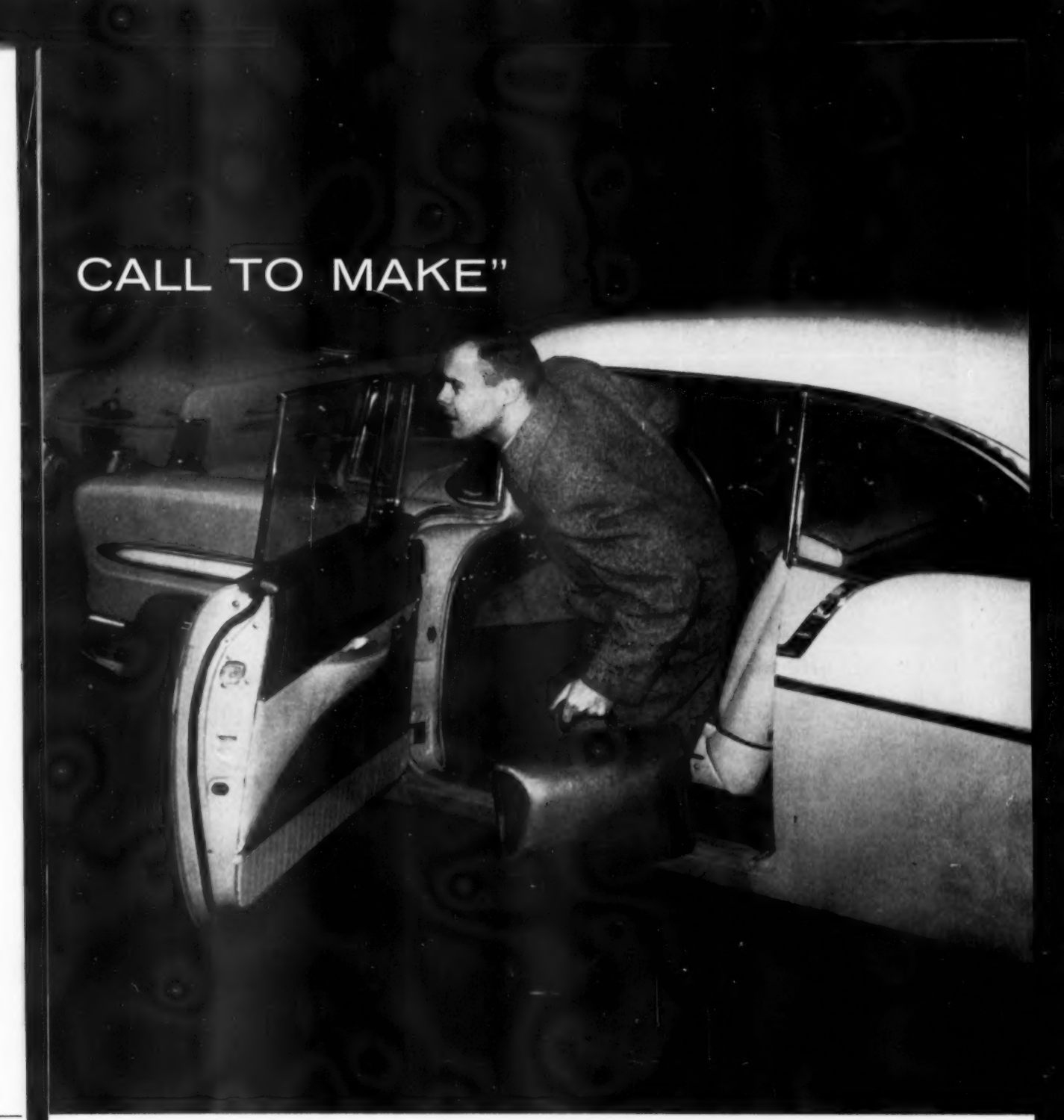


Regardless of how the distant manufacturer ultimately will compensate him, the distributor adjusts claims, returns goods, issues credits.

He trains and maintains a staff of salesmen who know the products required by the industry – where, how and when they are used.



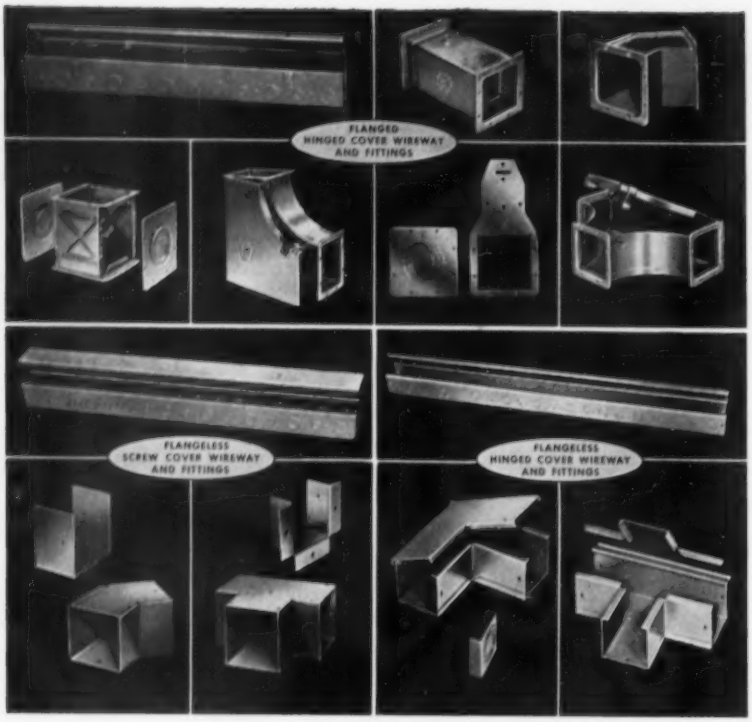
CALL TO MAKE"



He assembles into single shipments the products of factories near and far, in sizes, types, and quantities the user needs.

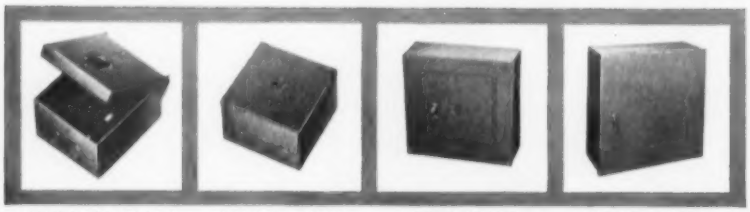
He maintains a warehouse from which you receive swift, economical delivery of a vast variety of products, plus staggered storing for specific jobs, as needed.

His counter and telephone service require trained men who know the hundreds of products handled, their uses, codes and ruling in effect locally.


FLANGED HINGED COVER WIREWAY AND FITTINGS
FLANGELESS SCREW COVER WIREWAY AND FITTINGS
FLANGELESS HINGED COVER WIREWAY AND FITTINGS

For fast, efficient installation, specify the

KEYSTONE QUALITY LINE



HINGED COVER CUTOUT BOXES | SCREW COVER PULL BOXES | TELEPHONE CABINETS | TRANSFORMER CABINETS

Here it is . . . the most extensive line of wireways and fittings on the market today! Yes, it's the Keystone Quality Line . . . with every item "job-engineered" to fit *right* into most any electrical distribution system, built *right* to speed installation, reduce costs, and increase profits. For example, both flanged and flangeless types of wireway are produced and stocked in a wide range of standard sizes and lengths, with or without knockouts. And special sizes or types are also available to meet unusual installation problems. There's a complete selection of auxiliary fittings to choose from, too, plus cutout and pull boxes in more than 50 different stock sizes . . . and a variety of telephone and current transformer cabinets to meet your particular needs. So save time, save money on wiring installation jobs . . . go "Keystone" all the way!

IT'S YOURS FOR THE ASKING!

A complete new fully illustrated catalog covering the entire "Keystone Quality Line" of wiring installation equipment. Send for your free copy today!

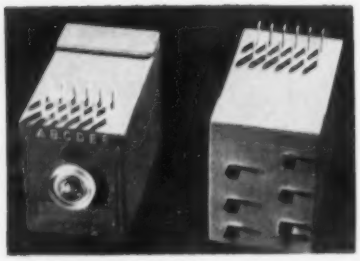
It pays to figure on Keystone

KEYSTONE MANUFACTURING COMPANY

23328 SHERWOOD AVENUE • CENTER LINE (Detroit) MICHIGAN

. . . the Complete Line of Wiring Installation Equipment

SOLD ONLY THROUGH RECOGNIZED ELECTRICAL DISTRIBUTORS



Control Unit (43)

A new plug-in static control unit designed to broaden the scope of static switching to include protective functions such as undervoltage protection, undervoltage release, switch volts protection, overvoltage limit, fault indication, and others. Unit provides protective functions by means of three electrically-isolated control windings, one of which is suitable for use in circuits up to 750 volts dc, on a magnetic amplifier unit. The encapsulated, plug-in unit is equipped with a monitor light which indicates at a glance whether or not the unit is in operation.

General Electric Co., Schenectady 5, N. Y.

Pushbuttons (44)

Designed for accessibility of wiring, distinctive appearance and flexibility, these new heavy duty oil tight pushbuttons are rated to 550 volts ac-dc. Line includes pushbuttons, pilot lights and accessories such as mushroom head, lever and key lock. All units are built around one standard contact block. No rights or lefts. Contact blocks can be used singly or in tandem, mounted vertically or horizontally. Operator consists of a metal button or selector knob which is free to slide or rotate within a metal sleeve. A special oil seal prevents oil from entering the enclosure and switching mechanism. Standard buttons are used. Catalog No. 5606 is available.

Furnas Electric Co., 1067 W. McKee St., Batavia, Ill.

these 2 words
CLIFTON CONDUIT
means everything in
RIGID
and
E. M. T.
With the name CLIFTON on your Conduit there's no need to look further, for CLIFTON means superiority in every way. Careful manufacture by CLIFTON'S special hot dip method gives double the zinc protection of ordinary conduit, both inside and outside. Using CLIFTON Rigid or E.M.T. Conduit adds that extra bit of integrity to every job you do. As contractors everywhere are doing every day . . . Specify CLIFTON Conduit.

WRITE TODAY
For Full Information

Warehouses Throughout the Country.

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FREE MANUAL

for Practical Electrical Men Tells How to Use the Popular

MEGGER® INSULATION TESTER

The Meg type of Megger insulation tester shown above is perhaps the most popular and most-used tester there is. It is available with a hand-crank generator for field use and with a separate or built-in power supply for repetitive inspection or production tests. Ranges available up to 2000 megohms, 1000 volts d.c. Optional accessory features include ohm scales 0 to 10,000 ohms and ratio and discharge switches.

The answers to many of your electrical maintenance problems are in the 100-page "Manual on Megger Insulation Testers". It answers questions like these:

What makes good insulation go bad?
How can you check it before it breaks down?
How does a Megger insulation tester work?
What testing procedures should be practiced?
How to interpret meter readings?
Does periodic testing pay off?

Write now on your company letterhead for this valuable manual together with helpful material on the practical and economical advantages of electrical preventive maintenance.

Write for BULLETIN 21-ECM.

8703

JAMES G. BIDDLE CO.

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.

Oil Switch (45)

A new FKC remote control oil switch for economical switching of capacitors, outdoor lighting and load break applications. The single-phase, 14.4 kv switch has a continuous current rating of 200 amps, and a momentary rating of 9,000 amps RMS symmetrical. Motor mechanism of switch can be controlled by a thermostat, voltmeter, ammeter or time switch, and can be removed for inspection or maintenance. Nitrile rubber gaskets on cover and bushing of switch are used for sealing. The tank of switch is of one-piece drawn steel, and is supplied with approximately 1½ gals of inhibited oil. Oil level may be checked by removing dipstick from switch cover.

General Electric Co., Schenectady 5, N. Y.

Mat Switch (46)

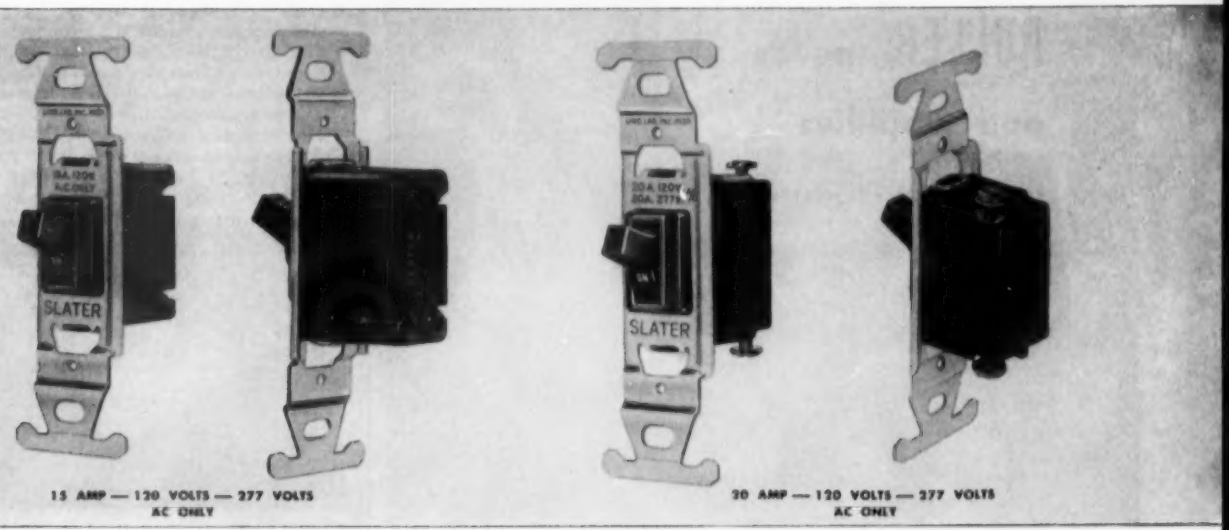
A new mat-switch for use in commercial, industrial and other institutions as electric door or gate control; lighting control; signal device control; safety switch control and intruder alarm control, etc. The flat-thin construction, ⅝-in., makes it easy to mount flat on any surface. The mat is sensitive to 5 lbs or more pressure and will activate by a person stepping on it or a vehicle passing over it. Relay control box connects to 110 volts, 1-phase, 60 cycle outl t, with 10 ft cord; contains transformer and relay which permits mat to operate on 12 volts. Has two control circuits, one normally closed and one normally open.

Robot Appliances, Inc., 7041 Orchard St., Dearborn, Mich.

Roof Ventilators (47)

New Type SRQ power roof ventilators reverse conventional ventilating procedure and blow air in instead of out. They are available in five sizes with low and high speed models, ranging in capacity from 1,310 cfm to 11,880 cfm. Unit is shipped completely assembled and enclosed in its alumi-

QUIET as a...

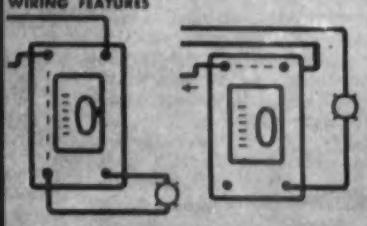


15 AMP — 120 VOLTS — 277 VOLTS
AC ONLY

20 AMP — 120 VOLTS — 277 VOLTS
AC ONLY

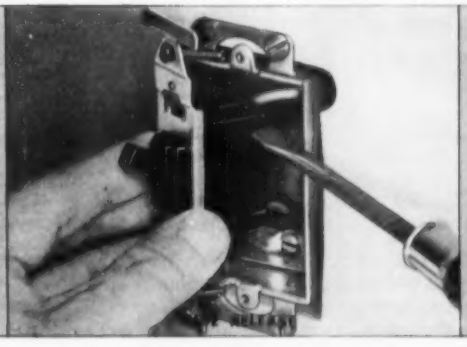
NEW! SLATER A.C. QUIET SWITCHES

WIRING FEATURES



THRU-WIRE SYSTEM
CATALOG NO. 601

LINE SHUNT
CATALOG NO. 605



LOADED WITH FEATURES

- NEW TYPE, "PLUS" SERVICE, SILVER CONTACTS
- THRU-WIRE SYSTEM OR BUILT-IN SHUNT
- "SPEEDWIRE" REAR WIRING OR SCREW TERMINALS
- EXCLUSIVE SIDE RELEASE; *(Patented)*
- OPERATES IN ANY POSITION
- EXTRA NEOPRENE BUMPERS FOR SILENCE

EASY to install • SIMPLE to remove • NO call backs

Available in single pole, double pole, 3-way and 4-way with ivory or brown feather-touch toggle, Slater's brand new line of ultra reliable quiet switches provide smooth, noiseless operation. Rated 15 amperes, 120 and 277 volts and 20 amperes, 120 and 277 volts. Slater quiet switches are made to serve your job requirements with perfect performance.

Slater A.C. Quiet Switches are easy to install. Next time save time, money and effort. Ask your electrical wholesaler for Slater Quiet switches with "speed wire" rear wiring and exclusive side release feature or with screw terminals.

SEND FOR CATALOG #35

SAY SLATER WITH CONFIDENCE

Slater
Lifetime Wiring Devices

SLATER ELECTRIC & MANUFACTURING CO., INC. GLEN COVE, NEW YORK.

pulls cable through all types of conduit . . . open or concealed

Here's an on-the-job view of a standard GREENLEE Cable Puller with a flexible elbow attachment making simple work of what could have been a mighty tough job.

In about five minutes, three 1,000,000-circular-mil cables were pulled through an 80-foot length of 4-inch conduit which is some 18 feet above the floor level. Setup time included, the entire job took approximately an hour and was handled simply, easily.

Whether you have high overhead jobs like this calling for the use of the attachment, or more routine work, you'll find the GREENLEE Cable Puller a big timesaver that helps get the job done faster, at lower cost. With it you *pull in line with the conduit.* When used without attachments for concealed conduit work, it clamps directly on the conduit. You get a fast, easy pull without straining conduit hangers and eliminate heavy, cumbersome equipment. Use it for open or concealed conduit . . . high up, in close quarters, or out in the open.

It's a powerful puller . . . exerts a maximum pull of 7,500 pounds and has two speeds: one for fast work, the second for a steadier, heavier pull.

Portable, easy to carry, set up and operate. Write today for complete reference folder on this and other GREENLEE timesaving tools for electricians. Greenlee Tool Co., 1743 Columbia Avenue, Rockford, Illinois.

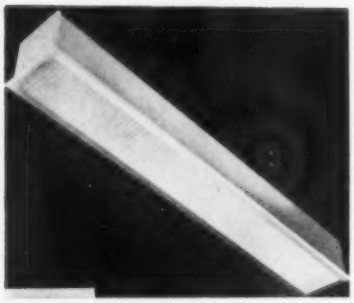
TOOLS FOR CRAFTSMEN
GREENLEE

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK

Hydraulic Conduit Benders • Tubing Benders • Auger Bits and Drills • Knockout Punches • And many more

num housing; propeller fan and permanent-split capacitor type motor are directly connected; all electrical connections are mounted outside housing for easy access; motor has permanently lubricated ball bearings; fan wheel is statically and dynamically balanced. Available with one phase and 3-phase motors. Shutters, either spring or motor-operated, with interconnected blades to eliminate drafts, are available as accessories. They are mounted in the base of the unit for accessibility. Literature is available.

Ilg Electric Ventilating Co., 2850 *N. Pulaski Rd., Chicago* 41, *Ill.*



Lighting Fixtures (48)

A series of one lamp shielded fixtures for recessed and surface mounting has been added to the Uni-Lite line. 4- and 8-ft channels are dieformed and welded of 20 gauge steel. Constructed to provide continuous wireways for continuous mounting, it also mounts individually. Surface unit has a metal one-piece frame basket containing diffuser and side panels. Recessed unit has a lay-in Polycube diffuser and uniform width end and side flange trim. Has its own pair of adjustable hangers for various ceiling types. 4-ft and 8-ft tandem rapid start and 8-ft and 16-ft tandem slimline. Both units are specifically designed for corridors, shelf stack lighting, perimeter lighting and various auxiliary lighting in stores, libraries, auditoriums, schools, church chapels or activity rooms.

Electro Silv-A-King Corp., 1535 *S. Paulina St., Chicago, Ill.*

Circuit Breaker (49)

A new plug-in circuit breaker with an isolated line terminal. Breaker makes it easy to connect an electric hot water heater to a separately metered, off-peak power source. It can also be used to connect an emergency circuit to an alternate power supply. Breaker plugs into all standard G-E load centers and eliminates necessity for installing a separately enclosed protective device for off-peak or alternate power circuits. Device is listed by UL and contains a thermal-magnetic trip element.

Circuit Protective Devices Dept., General Electric Co., Plainville, Conn.

Heat Pump (50)

The size of the new Weathertron heat pump is ideal for slab or crawl space home construction. Its dimensions are 30¼ in. by 33¼ in. by 46 in. and can be built into the wall of the home. Unit serves as a horizontal, vertical or down-flow air conditioning system. Placed on outside wall, it can project as little as 14 in. into the home. Servicing of unit can be done from either inside or outside. Return air grille, which is an accessory, and filter may be located remotely from unit when installed in a tucked-away waste space. Air distribution is available for ductless applications. Unit has sufficient fan capacity for small round duct air-wall type systems.

General Electric Co., Bloomfield, N. J.

Product Briefs

(51) Supro Lux Manufacturing Co., Bronx, N. Y., has developed a new T12 60 in. slimline fluorescent **lamp**. . . . (52) A 15-ft swivel type **Lift-A-Loft** for overhead maintenance is designed for narrow aisle spaces and working heights of 20 ft. It is manufactured by Lift-A-Loft Company, Muncie, Ind. . . . (53) A new line of universally adjustable incandescent and fluorescent **lighting units** for industrial and commercial applications, known as Dextra-Lite, has been developed by Swivelier Company, Inc., Brooklyn, N. Y.

(54) Black & Decker Manufacturing Co., Towson, Md., has redesigned its line of portable electric **saws**. . . . (55) Ohio Carbon Co., Cleveland, Ohio, states that performance of its new "D Series" of **brush grades** under adverse conditions has been fully proved. . . . (56) New **magnetic mounting** for transformer thermal overload indicators are available from Line Material Co., Milwaukee 1, Wis. . . . (57) Barth Corporation, Cleveland, Ohio, has developed a new tapered **fish tape** for ¼ and ⅜ in. tapes.

(58) A battery **cell filler**, called "Rite-Hite" cell filler, developed especially for railway service is now being made available to industrial plants by Gould-National Batteries, Inc., Trenton, N. J. . . . (59) A polyethylene **protective cover** for wire and cable splices is being distributed by Plastic Engineering and Sales Corp., Fort Worth, Texas.

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THE FAMOUS BRONCO LABEL

Shown Here In 5/6 Actual Size

"We certify that the jacket of cable branded "Bronco 66 Neoprene Certified" contains not less than 67.32% of new Neoprene.
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portable cord and cable

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W, G. WELDING, CONTROL CABLES
SO, SJO, SV-NEOPRENE CORDS
SO & W SHIELDED CORDS AND CABLES
CORDS & CABLES MADE ESPECIALLY FOR USE ON PAYOUT & RETRACTABLE REELS

sizes

18 THROUGH 4/0 AWG
with from
1 TO 36 CONDUCTORS

feet

250' COILS AND REELS,
AND BIG CABLES IN LENGTHS
FROM 10 to 1000 FEET, AND
LONGER ON SPECIAL ORDER

the shortest distance between maintenance men and high-bay lights

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SPEED . . . SAFETY . . . SAVINGS. These are the inherent benefits of servicing luminaires at floor level. Thompson Hangers save dollars . . . not just cents . . . on maintenance budgets in all types of buildings where lights are mounted 16 feet or more above the floor.

Working with Thompson Hangers, one man can lower, relamp and clean, and then reposition a luminaire within minutes. He has both feet on the floor at all times . . . is completely safe from electrical dangers.

Thompson Hangers are foolproof, easy-to-operate, inconspicuous. They also are the most practical, efficient and economical means of maintaining inaccessible lights.

FOR COMPLETE DATA AND SPECIFICATIONS, SEND FOR NEW 8-PAGE BULLETIN TH-56 . . . OR CALL SUPERIOR 1-7626.

THE THOMPSON ELECTRIC CO.
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CATALOGS and BULLETINS

(60) INTERLOCKED ARMOR CABLE systems installation practices are detailed in new 36-page booklet. Photographs show terminations and splices; connections to switchgear, motors and plug-in bus; special installation problems; typical installations; and "before" and "after" illustrations showing the older wiring system side by side with new interlocked cable system. General Electric Co.

(61) HOME LIGHTING ideas are packed into the 40-page revised edition of "See Your Home in a New Light". Exact measurements for most desirable placing of equipment, information on bulbs, equipment design and integration of lighting with home decor are featured. General Electric Co.

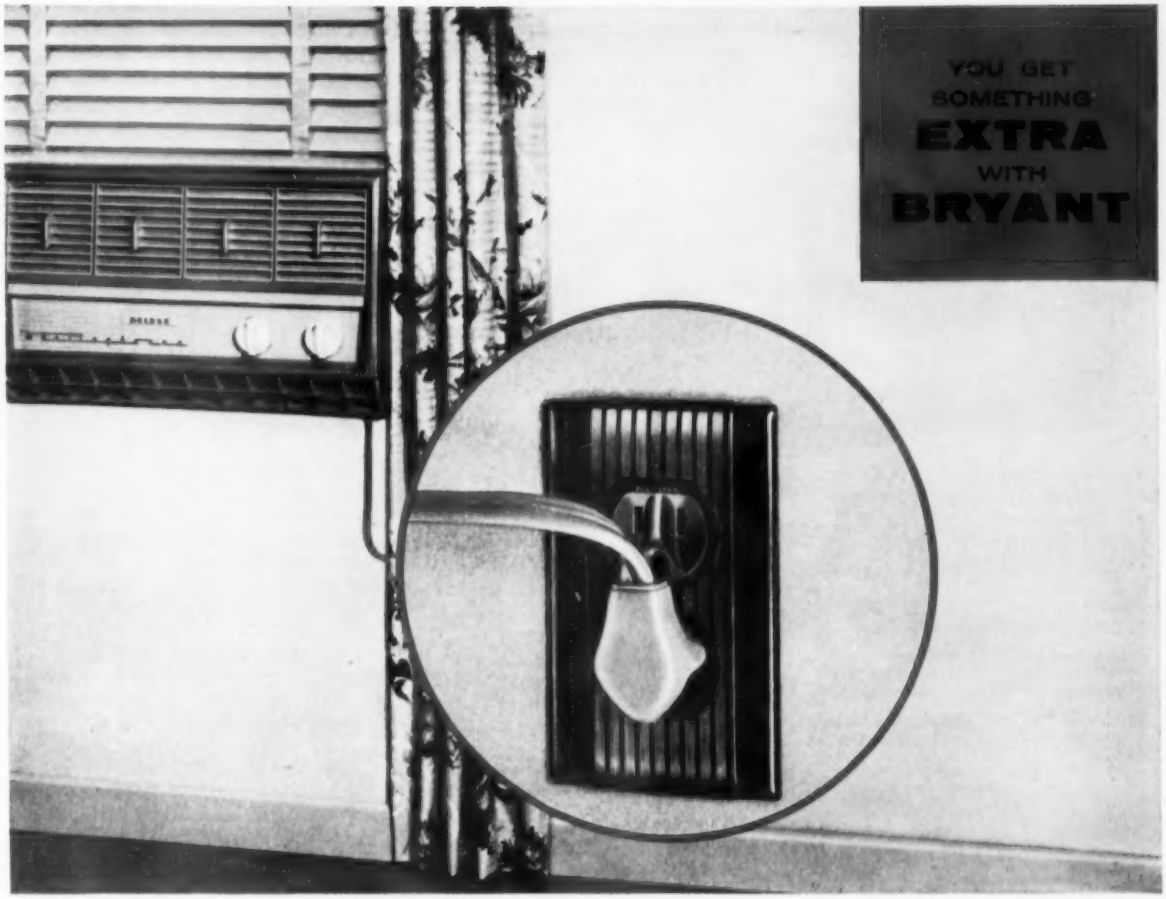
(62) TIME SWITCHES with seven-day setting capacity for heating systems, air conditioning systems, lights and fans are described in 2-page bulletin. International Register Co.

(63) POWER CENTERS, 300 kva and below. Bulletin CS-1010 gives complete engineering data, weight, dimensions and detailed schematic drawings of self-contained indoor units. Kuhlman Electric Co.

(64) PLATE-TYPE RHEOSTATS. Selection information, applications, features and six basic modifications of standard line are described in 8-page Bulletin GEA-6474. General Electric Co.

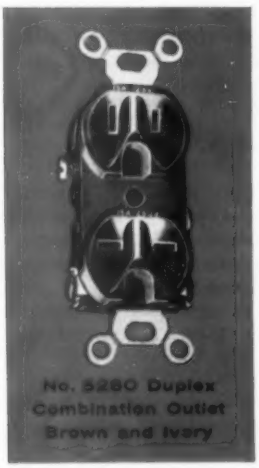
(65) PUSHBUTTONS. 32-page catalog describes oil-tight and general purpose line, including dimensions, cam action and schematic diagrams. All types and components are illustrated. Furnas Electric Co.

(66) AIRCRAFT SWITCHES are illustrated and described in 32-page Catalog 78, covering complete line of hermetically sealed and high-phenolic encased aircraft switches as well as small, metal-covered temperature switches. Photographs, dimensioned drawings and electrical data cover wide variety of actuator designs, terminal structures and contact arrangements. Micro Switch.



BETTER GROUNDING DEVICES

for the Biggest Air Conditioner Market In History



Get ready now for the biggest air conditioner market in history by stocking Bryant quality grounding devices. The complete Bryant line, for either 15 amp-125v or 15 amp-250v (NEMA and ASA Standard configurations) assure once installed-stay installed service.

OUTLETS – Exclusive breakproof U-type grounding slot; locked-in mounting straps; welded grounding contacts.

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SUPERIOR WIRING DEVICES

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- REPLACE WELD-ON LUGS
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Hub-Lugs (patent applied for) fit the sizes of Ideal-Simplet Rectangular and FS, FD fittings *only*. A low-cost mounting of fittings in wiring systems for industrial and commercial work.

PERFECT FOR MACHINERY electrical systems. The only *safe* method for a moisture-proof, strong, rigid, durable mounting of fittings!

Best ... and only completely REUSABLE CONNECTORS for liquid-tight flexible metallic conduit

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Easy to apply. Positively seal out vapor, oil, water, dust. Tremendous gripping power thru serrations on split ring. U.L. Approved by 200-lb. pull test. Fit both EF and UA conduit.

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(67) ARC WELDING machines and accessories including selenium rectifier and dc motor-generator arc welders, engine-driven arc welders and transformer arc welders are illustrated and described in 44-page catalog. Air Reduction Sales Co.

(68) DC MAGNETIC BRAKES in 8, 10, 13, 16, 19 and 23-in. wheel sizes is described in 8-page Bulletin GEA-6214, including installation and maintenance procedures, applications, diagrams and tables. General Electric Co.

(69) MOTORS may be selected using new 12-page Application Guide. Reference to tables listing equipment and machinery to be driven identifies character of the load, speed of operation, starting and running torques, surrounding atmosphere and frame size, resulting in the correct motor for the application. Century Electric Co.

(70) FACADE LIGHTING for service station building illumination is described in new 12-page catalog. Actual installations with construction details are included. Guardian Light Co.

(71) EMERGENCY LIGHTING UNITS. Complete specifications, plus descriptions of associated power systems, exit lights and hand lamps are given in 4-page bulletin. Electric Cord Co.

(72) HIGH-VOLTAGE STARTER for motors operating on systems up to 50,000 kva are described, illustrated and dimensioned in 2-page Bulletin GEA-6451. General Electric Co.

(73) SIGNALLING EQUIPMENT. 56-page catalog supplies descriptive data, specifications, prices, installation advice and dimensions of audible signals, pushbuttons, intruder alarms, transformers, annunciators, and other products. Auth Electric Co., Inc.

(74) FLUORESCENT LUMINAIRES with interchangeable bottom panels for ceiling or surface mounting are covered in 16-page bulletin, including complete specifications, distribution curves and photographs. Sechrist Mfg. Co.

(75) FLUORESCENT LIGHTING Guide Book FL-578 for commercial and industrial users of fluorescent lamps and equipment contains 24 pages of specifications, drawings, photographs and lighting basics. Sylvania Electric Products Inc.

(76) ROTOR SWITCHES rated at 30 amps for control and protection of lighting circuits, furnaces, food freezers, air conditioners, and other equipment are illustrated with suggested specifications in 4-page Bulletin RS. BullDog Electric Products Co.

(77) TROLLEY BUSWAY electrification of moving test lines is described in Bulletin 57. System permits testing of products while being transported along production line conveyor. Feedrail Corp.

(78) PORTABLE POWER TOOLS for the manufacturing, construction, woodworking and metalworking industries are pictured with complete specifications in new 1957 50-page catalog. Skil Corp.

(79) SHELVES, CABINENTS and other office and shop equipment are pictured with complete descriptions and prices in 24-page handbook. General Industrial Co.,

(80) LIGHTING UNITS. New RLM Standard Specifications for Industrial Lighting Units contains revisions in specifications on both incandescent and fluorescent industrial lighting units, new coefficient of utilization tables, and revised light distribution curves. RLM Standards Institute.

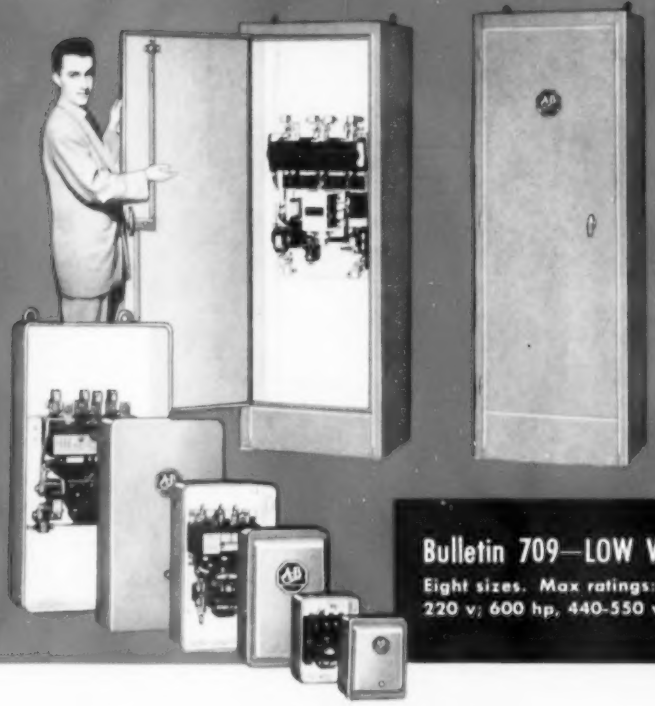
(81) TEMPERATURE CONTROL which opens circuit when a preset temperature is reached and remains in open position until reset manually is described in 4-page bulletin. Included are several diagrams and cutaway drawings of installation and mechanism. Robertshaw-Fulton Controls Co.

(82) AIR CONDITIONERS. A pocket-size flip-chart booklet includes sketches and written descriptions outlining the functions of each component part of the air conditioner, its location, and its importance to the whole unit. Mitchell Mfg. Co.

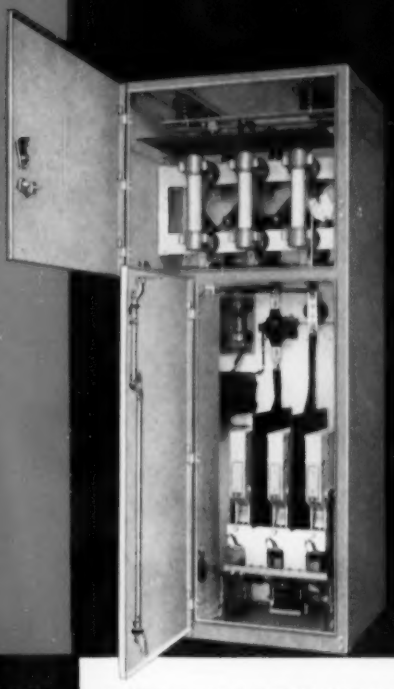
(83) SOLDERLESS TERMINALS and connectors for wire sizes AWG 10 to 16 are illustrated and described in 8-page bulletin. Tables and drawings give complete dimensions. Electric Terminals Corp.

(84) WIRING DEVICES for residential use are pictured in new bulletins and specifications sheets.

a complete line—



Bulletin 709—LOW VOLTAGE
Eight sizes. Max ratings: 300 hp, 220 v; 600 hp, 440-550 v.



Bulletin 1159—HIGH VOLTAGE
Two sizes. Max ratings: 1500 hp, 2300 v; 2500 hp, 4600 v.

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About 25 years ago, Allen-Bradley introduced the first modern *solenoid* starter . . . a revolutionary new design. Because of its simple construction and the resultant greater reliability, this starter became the model for the industry. Other manufacturers brought out solenoid starters in the lower ratings, but—only Allen-Bradley offers a full line of *eight* sizes. Like their smaller brothers, the higher rated starters provide an extremely long life and unfailing reliability.

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all have *DESIGN SIMPLICITY* for trouble free operation

- **Only one moving part. No pins, pivots, or flexible jumpers.**
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- **Compact switch mechanism provides plenty of wiring space.**
- **Reliable overload relays protect the motor at all times.**

A-B Quality

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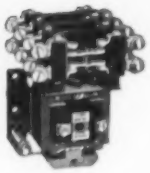
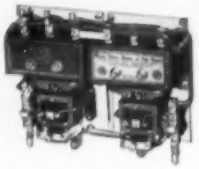
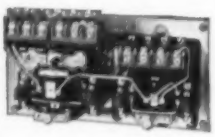


Bulletin 700
Universal Relay with
N.O.—N.C. Contacts



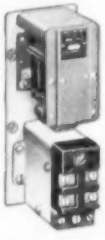
Bulletin 705 Size 2
Reversing Starter



Bulletin 715 Two
Speed Consequent
Pole Starter

Bulletin 802T Adjustable
Lever Oiltight Limit
Switch

Bulletin 702 Three Pole
Size 2 Contactor



Bulletin 849 "On-Delay"
Pneumatic Timer

Bulletin 892
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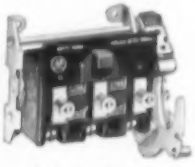
Blocks

Bulletin 704, Mechanically
Held, Hum-free Relay

Bulletin 200
D-C Relay

Bulletin 350
Reversing Drum Switch

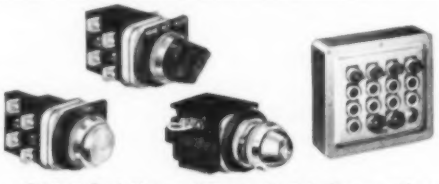
Bulletin 836
Pressure Control in
NEMA Type 4 Enclosure



Bulletin 894
Visible Blade
Disconnect Switch

Bulletin 709
Size 4 Automatic
Starter

Bulletin 609
Three Phase
Manual Starter



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Pilot Light, and completely assembled Oiltight Station

Allen-Bradley *quality* components assure you millions of trouble free operations. The simple design, maintenance free, double break, silver alloy contacts, and rugged design features have made them the first choice among design engineers, contractors, and maintenance men. You just can't go wrong with this QUALITY line.

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3-57-MR

Products include convenience and grounding receptacles, outlet plates and switches. Sierra Electric Corp.

(85) RECTIFIER EQUIPMENT from individual components to complete power supplies is illustrated and described in new catalog. American Rectifier Corp.

(86) PAGING AND ALARM systems for residential use. 16-page booklet provides builders and electricians with practical text and wiring diagrams on six low-cost systems incorporating door chime with sickroom call system, telephone calls, intruder alarm and freezer alarms. Edwards Co., Inc.

(87) AUTOMATIC CONTROLS for single stage pressure, 2-stage pressure, temperature, liquid level and mechanical movement are listed in new catalog covering over 100 items, including complete line of relays and mercury switches. Mercoid Corp.

(88) POWER ELECTRIC PLANTS, earth boring machines and 2-way flasher lights are covered in new 36-page catalog. Included are specifications, diagrams and photos, plus information on operation, maintenance and service. Gen-A-Matic Corp.

(89) PLUG-IN BUS for low-voltage-drop feeder applications. 26-page catalog contains photographs and dimensioned drawings of housing, bus, components and accessories; application drawings and photograhs; complete specifications, and sample calculations and layout drawings. Electric Distribution Products, Inc., Allentown, Pa.

(90) TEMPERATURE CONTROL of industrial furnaces—a series of six articles discussing basic control systems, thermocouples and other instruments, and special control systems. Publication GER-1206, 21 pages. General Electric Co.

(91) BALLASTS for general line fluorescents, plastic signs and outdoor applications, dimming and flashing, germicidal fluorescents, rapid-start and circline lamps, and dc operation. Wiring diagrams, list prices and electrical specifications of complete line. Bulletin GEC-983J, 12 pages. General Electric Co.

(92) VARNISHED-CAMBRIC CABLES in voltage range of 600 to 5000 volts, single- and 3-conductor, braided or lead-sheathed, plus armored cable constructions in both

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known for **QUALITY...**

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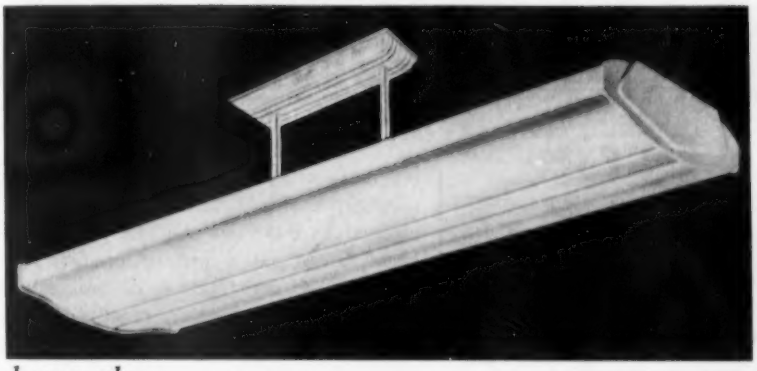

lume-glow

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Patented, No. RE23649 and other patents pending.

ONLY 2 PARTS

Crimp sleeve with IDEAL Electricians Pliers.

Apply "Wrap-Cap" and pull tabbed cap between wires and over ends.

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No other crimp connector ever like it for simplicity and safety! Anyone who can use a pliers can make this vise-tight joint in seconds! Gives you a perfect, pre-fabricated insulating job every time — *all around* and *between* the wires. Puncture proof, with double thickness over wire ends. Steel sleeve is cadmium plated — vibration proof, non-crystallizing. "Wrap-Cap" is made of same long-lived vinyl material used on TW wire.

NO EXTRA TOOL NEEDED

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IDEAL All-Purpose
ELECTRICIANS PLIERS

No finer pliers on the market for all-around electrical use. "Double-crimps" sleeves for stronger joints, twists and cuts wires, burrs conduit. Comfortable plastic handles are non-burning, non-explosive. Guaranteed finest quality by IDEAL.

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galvanized steel armor and aluminum armor for 3- and 4-conductor cable. Photographs and complete specifications. 22-page bulletin. Rockbestos Products Corp.

(93) HEATING CONTROL by outdoor thermostat. Bulletin GEA-6530 describes system operation and illustrates components for residential use. General Electric Co.

(94) STEP VOLTAGE REGULATORS—designed features, applications, wiring diagrams and electrical data for 20 single-phase ratings. 2 bulletins. General Electric Co.

(95) SWITCHES of pushbutton, lever and turn design. Included are illustrations, ratings, dimensions and ordering information. 4-page catalog No. 200. Donald P. Mossman, Inc.

(96) PANELBOARDS with 70- and 100-amp main disconnects for 3-wire services up to 200 amps. Panel diagrams and illustrations, including new 100-amp, 2-pole common trip pushmatic. 4-page foldout. BullDog Electric Products Co.

(97) EMERGENCY LIGHTING systems for hospitals, schools and other commercial and institutional buildings using 32-volt nickel-cadmium batteries. Illustrations, layouts, performance charts. 12-page bulletin No. 243. Standard Electric Time Co.

(98) MAT SWITCH and automatic operators for commercial and industrial doors are illustrated and described in 2- and 4-page bulletins. Included are installation instructions and drawings showing possible applications. Robot Appliances, Inc.

(99) EXPANSION ANCHOR for hollow walls, floors, ceilings, glass, ceramic tile or other materials. Illustrations, installation instructions, and dimensions. 2-page Bulletin No. 7900. Diamond Expansion Bolt Co., Inc.

(100) STANDARDS PUBLICATIONS guide describes more than 150 standards publications issued by subdivisions of the National Electrical Manufacturers Association covering appliances, illuminating equipment, signalling and communications equipment, industrial apparatus, building equipment and supplies, insulating materials, insulated wire and cable, and gen-

eration, transmission and distribution equipment. National Electrical Manufacturers Assn.

(101) WELDING CABLE of aluminum rated from 100 to 400 amps and over. Table gives sizes, weights and voltage drops; photos illustrate accessories. Second bulletin provides instructions for soldering cable. Tweco Products, Inc.

(102) INSULATING MATERIALS—12 pages of listings. Common names and trade names of products are cross-indexed for ready identification; last two pages identify insulations with manufacturers. Insulation Manufacturers Corp.

(103) STEEL EQUIPMENT including all types of steel shelving, drawers, lockers, work benches, tables and other storage, shop, store, office and warehouse equipment are listed and analyzed in 48-page reference manual No. 485. Equipto.

(104) VENTILATORS for roof mounting are depicted in 4-page brochure giving dimensioned sketches, photos, and a table of capacities at various pressures for sizes ranging from 1/80 to 2¼ hp. Ilg Electric Ventilating Co.

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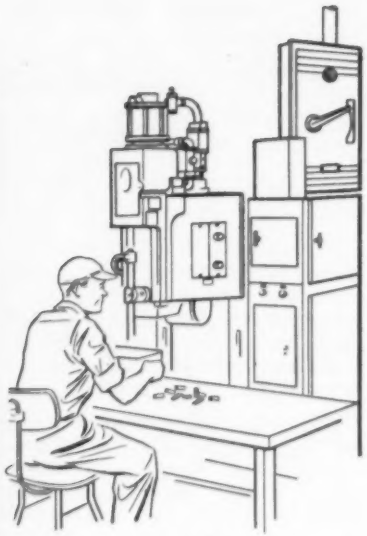

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Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Checking Armature Windings

QUESTION L31—I have heard that low-resistance ohmmeters have been found valuable in checking armature windings, especially in direct-current series-type machines, for high-resistance joints or other coil troubles. I wonder if any reader has had experience with this device, and if it can be used as a preventive maintenance tool as well as for shop testing of rewound armatures.—D.H.N.

ANSWER TO L31—I have used ohmmeters designed for low resistance on machines from sub-fractional dc motors to large rotary converters. Shorts, opens, and bad connections can all be found using an instrument of this type. Usually a comparison of the results of identical tests on the same machine is all that is necessary. An advantage for maintenance work is that tests for these faults, using this instrument, can normally be made without disassembly of the machine.—H.C.

ANSWER TO L31—Low resistance ohmmeters are very valuable in checking armature windings and in fact any connection for conduction. We use a Biddle Ductor for all sorts of high-resistance joints. We check the complete generator at periodic intervals for signs of trouble. When trouble is evident, we localize trouble such as thrown solder etc., by this method.

We check the contact on disconnects by this method, particularly silver ball types. One of our most frequent uses of the Ductor is to check switches, such as air breakers, FH series of oil breakers, etc. This is by far the quicker method to determine the best pressure available for a particular main contact on the FH series. This prevents a hot contact and the rest of the trouble as a result of improper connection.—J.W.L.

Painting Transformers

QUESTION M31—Will painting substation transformers with aluminum paint lower the operating temperature enough to justify the expense of painting?—H.G.R.

ANSWER TO M31—Painting transformers with aluminum paint will reduce the heat radiation of the transformers and consequently increase their operating temperature. Reference to the American Society of Heating and A.C. 1956 Edition, Page 95, Table 3, shows the comparative emissivity of various materials compared to a black body. Bright aluminum paint has a factor of .4 to .6 which means that it will emit only 40 to 60% the amount of heat that a black body will emit. The transformers should be painted with a good grade of long lasting weatherproof dark colored or black paint—but definitely not aluminum.—R.E.B.

ANSWER TO M31—In general gray paint of the type commonly used on power transformers will radiate more heat than it will absorb from sunlight, whereas the radiation and absorption of aluminum paint are equal. Transformers in the shade may operate 7% to 12% hotter if painted with metallic paint than if painted with non-metallic paint. Transformers in direct sunshine even under the most favorable conditions (white lead paint, smooth tank surface, and a hot sunny day) operate only 2 or 3°C cooler than a standard gray transformer.

Therefore, repainting should be based on durability and appearance rather than heating. For additional information see "Transformer Engineering," a book published by John Wiley, second edition, 1954.—L.D.B.

ANSWER TO M31—A considerable amount of work has been done in regard to examining the effects of finishes on the heat dissipating capabilities of transformers. If transformers are exposed to sunshine, as most of them are, it is necessary to take into consideration the heat absorbing characteristics of the transformer finish as well as the heat emitting characteristics.

Aluminum paint has a coefficient of 0.55 for both emission and absorption. Non-metallic gray paint, or green paint, on the other hand, have a heat emission coefficient of 0.95, while the heat absorption coefficient is 0.75.

The conclusion that has been accepted in the industry is that transformer finishes should be selected from the standpoint of durability and appearance rather than from their thermal properties.—R.J.B.

FHP Motors

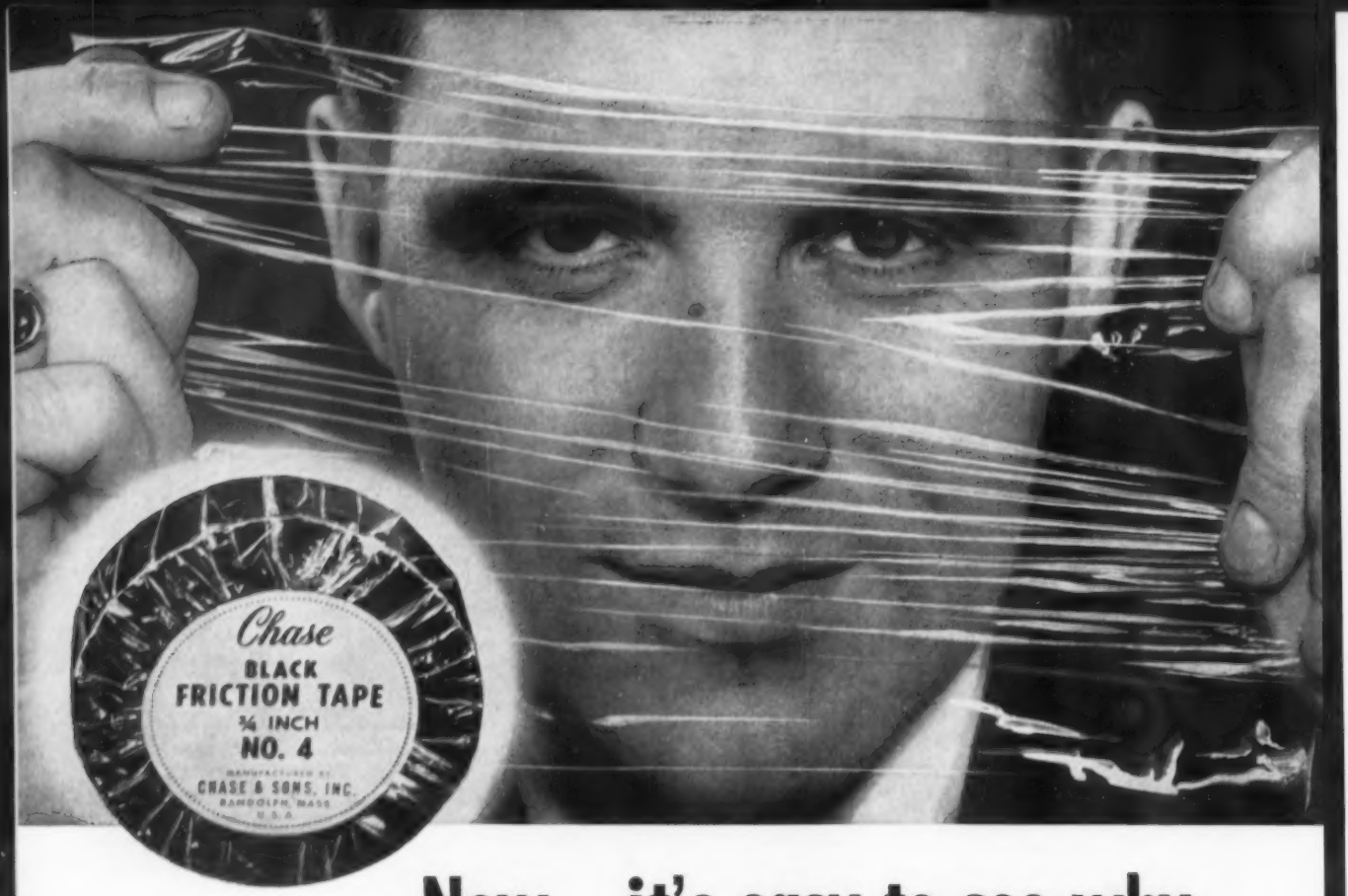
QUESTION N31—Can a single-phase fractional-horsepower motor rated at ¼ hp, 115 volts be connected by using some external device to operate at some reduced speed in order to obtain a 2-speed motor without considerable overheating? The motor could be a split phase type or a capacitor start.—J.B.K.

ANSWER TO N31—The conventional split phase or capacitor start motor cannot be used for any great degree of speed reduction. This is due to the fact that the centrifugal switch would not operate if there were any appreciable reduction in speed. The result would be a burned out capacitor or starting winding. A small, almost insignificant reduction in speed would be possible by lowering the voltage—using a reactor, resistor, or adjustable transformer.

Special motors are made using the devices mentioned above for speed control. They are designed so that the starting winding can be energized continually. Even these are suitable only for loads where the torque decreases as the speed decreases—such as direct-connected fans.—R.J.S.

ANSWER TO N31—Since single-phase split phase or capacitor start motors require a speed of 75% to 80% of full speed before the starting winding is disconnected, it is not possible to obtain speeds below this value without overheating and burning out the starting winding. Therefore, it is not practical to use single-phase motors of the above type as two-speed motors.—J.M.

ANSWER TO N31—A split phase or capacitor single phase motor can be operated at low speed if provision is made to open the starting winding, as is accomplished with



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hermetically sealed motors.

A series normally open relay is installed, the operating coil being connected in series with the main motor winding and the relay contacts connected in the starting winding circuit.

The inrush current, being four or five times the motor running current, causes the relay contacts to close the starting winding but opens the starting winding when the current drops to normal running value.

A rheostat installed in the main circuit is necessary to vary the speed.

A standard series relay as used with a ¼-hp hermetically sealed motor might work all right, but to check I would start the ¼-hp motor then disconnect the starting winding, the motor being loaded. Turn the rheostat to reduce the speed to the lowest desired RPM and obtain the running current value.

The relay must drop out when the current is a little higher than the running current value. The manufacturer can tell you at what value of current the relay will open.

If no change is made between motor and load, there will be no excessive heating due to the fact that as the speed decreases the load decreases.—B.A.S.

Transformer Impedance

QUESTION P31—We have in our plant a 3-phase transformer bank connected delta-delta, 4160-240, 500 *kva, approximate impedance* 5.1% *at rated volts, 75°C. Will someone please explain the meaning of "approximate impedance* 5.1%*" and how this is used in short circuit calculations?—J.M.*

ANSWER TO P31—A 5% impedance of a transformer means that at full load there will be a 5% voltage drop.

While this is valuable to know from a voltage regulation viewpoint it is also important to know this when figuring interrupting ratings of circuit breakers.

Referring to first paragraph, if 5% drop results from a normal current flow then a short circuit would result in a 100% voltage drop or 20 times normal full load current would be possible.

For example say you have a 500-kva transformer, 5% impedance, full load current 2400 amps.

Short circuit current, being only limited by transformer impedance, would be 2400 times 20 or 48,000

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amps. Now this knowledge would be a factor at a service entrance point where the run from the transformer to this point would be negligible. A breaker at this point should be able to withstand such short circuit currents. Of incidental interest is that the necessity for this breaking capability diminishes rapidly along the secondary conductor run with its inherent impedance. For instance a mere 100 ft of secondary run could reduce this possible short circuit current from 48,000 to 20,000 amps. The explanation of this further is beyond the scope of your question. I have elaborated a bit however in order to give you a wider picture of the use of impedance of transformers. —E.M.

ANSWER TO P31—Just as conductors present a series resistance and reactance in a circuit, so do transformers. Although this apparent series impedance can be expresed in ohms, it is also useful to express it in per cent of the given base impedance which is almost always the ratio of rated voltage to rated current. The reason for using per cent rather than ohms is that this technique removes the necessity for taking into account actual voltages, currents, turns, ratios or the manner in which a transformer bank is connected: delta delta, Y-delta, etc. For only one device this is not so important, but when it comes to combining several transformers, some intermediate conductors and any other intermediate passive network, the concept of per cent and per unit is quite useful. First, to illustrate what is meant by per cent impedance in this particular case, notice that the base impedance of this particular transformer bank would be defined as

$$Z = \frac{E}{I}$$

$$\text{or } \frac{240}{1200} = .115 \text{ approx.}$$

This represents the value of impedance which when connected to each of the three lines out of the transformer in Y would result in rated current flowing. Therefore, by definition the apparent series impedance of this transformer is 5.1% of .115 ohms or .0059 ohms referred to the secondary side. So much for the meaning of "per cent impedance". Now let's see how to use it in a simple short circuit calculation.

If we assume that a direct 3-

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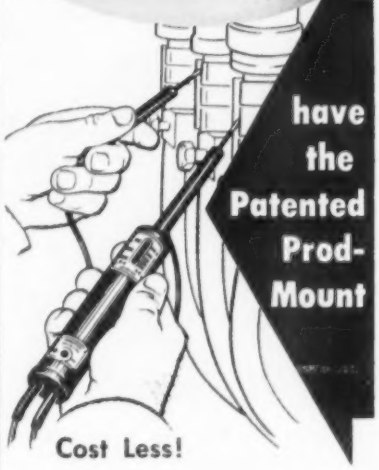

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phase line-to-line-to-line short circuit occurs on the secondary side of the transformer, and we want to compute the available short circuit current into this fault, the first decision that has to be made is how far back in the system supplying this particular transformer will the voltage remain practically constant under these fault conditions. Now, of course, this depends entirely upon how large the system actually is. The closer in to the fault we assume the voltage to remain constant, the worse these fault currents will be, because the less impedance will be included. For instance, in our particular case let us assume that the primary voltage of this transformer is supplied by a feeder system with sufficient capacity that this primary voltage will scarcely change upon the secondary fault being imposed. In this case the voltage into the transformer would be called 100% or 1.0 per unit and the current would be called 100% or 1.0 per unit and the current would be

$$I = \frac{E}{Z} \text{ or } \frac{1.0}{.051} = 19.6$$

The 19.6 then tells you how many times normal current will flow into the fault, and since the normal or rated current on the secondary of the transformer is approximately 1200 amps, we would expect that the short circuit current would be 1200 x 19.6 = approximately 23,500 amps. Actually, at the instant of fault application there may be an additional current flow due to transient offset of the current wave, and it is generally assumed that this could contribute as much as 25% more current. In our case, then, it could result in a total fault current of approximately 29,400 amps. This gives the user some idea of the necessary interrupting capacity of a circuit breaker which might immediately precede a fault in any given position.—D.F.

Can You ANSWER These QUESTIONS?

QUESTION Y31—We have a 45-ft pressure treated pole in which holes are bored at approximately 15 ft from the ground. On the pole we used standard ⅝ in. galvanized hardware. We use a ⅞ in. drill to make the holes. In some of the older installations, the lineman drilled two holes at 90° to each other and separated by only 1-in. of spacing. The pole diameter at this

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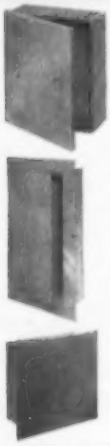

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point was 10-in. What fractional part of the total strength was lost by the drilling? Is there any code that designates the minimum spacing between holes when drilling at 90° from each other? In a case like this would it be advantageous to use pole bands with attachments set at 90° to one another and not drill the pole at all?—M.D.

QUESTION Z31—We are using a 3-phase, 220-volt, ½ hp motor to drive a 500-lb trolley at a speed of 100 ft per minute. We drive this trolley 10 ft then brake it to a stop in approximately 7 in., after which the trolley is returned to center and the cycle repeated.

We are using a friction disc-type mechanical brake, but find that this brake is affected by rapid wear, humidity and dirt. Therefore, we cannot obtain the precision and accurately positioned stops that are necessary for this operation. Can someone help with this problem?—J. M.

QUESTION A32—There is a demand in my territory for a lawn sprinkling system using a single valve having six or eight pipe connections. Only one water pipe is to be supplied at a time, the valve having means to turn the supply from one pipe to another. To motorize the valve and control it by means of a time clock would be the ultimate aim in developing this system, the idea being to automatically supply water to one outlet for approximately a half hour and then to succeeding outlets for a half hour each.

Have any of the contributors to the Quiz section had any experience or knowledge that would be useful in the development of the system described?—B.A.S.

QUESTION B32—Some copper wires of the same size and number of strands are more brittle than others. Is this the fault of the copper refining process or the insulation?—H. S.

QUESTION C32—I have a delta-connected 440-volt resistance heater. The resistance of one side of the delta is 150 ohms. How do I find the watt rating and amp rating?—A.P.

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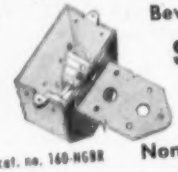

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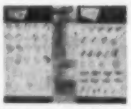

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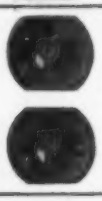
	2515 PARALLEL SLOT DUPLEX RECEPTACLE 3 WIRE GROUNDING Wide Ears—Double Contacts **15** Amp.—**125** Volts	2517B PARALLEL BLADE 3-WIRE CAP Heavy Bakelite—"U" Shaped Blade for Grounding Cord Hole Diameter .437
	2525 TANDEM SLOT DUPLEX RECEPTACLE 3 WIRE GROUNDING Wide Ears—Double Contacts **15** Amp.—**250** Volts	2527B TANDEM BLADE 3-WIRE CAP Heavy Bakelite—"U" Shaped Blade for Grounding Cord Hole Diameter .437

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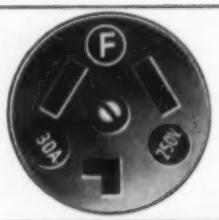

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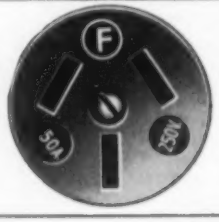
Flush or Surface Mount
Polarized with "L" Shaped Grounding Slot
30 Amp.—**250** Volts



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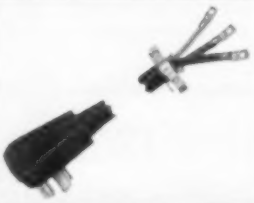

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Questions on the Code

Answered by:
GLENN ROWELL, *New York Board of Fire Underwriters, Rochester, N. Y.*
B. Z. SEGALL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. A. McDONALD, *Consulting Electrical Engineer, New Orleans, La.*

Protection Against Lightning

Q. *Please give me the following information:*

Names of manufacturers of lightning arrester materials, such as, braided aluminum, bare wire size 2 and size 0 aluminum staples, also aerial rods and ground rods for the purpose of protecting buildings from lightning.

We would appreciate very much if you would tell us the requirements of the National Electrical Code of the spacing distance of the aerial rods and the ground rods; also sizes of rods and sizes of wire; which is preferable, aluminum or copper wire; and size of wire.—W.A.

A. The question of protecting buildings from lightning involves many considerations which vary with the nature of the building structure and other factors. The subject is completely covered by standard No. 78 of the National Fire Protection Association which may be obtained at a small fee by applying direct to this Association at their office located at 60 Batterymarch Street, Boston, 10, Mass. Materials such as rods and fittings suitable for lightning protection are listed under the label service of Underwriters' Laboratories. There are 31 different manufacturers of such equipment, located in various sections of our country, whose materials are listed in the Electrical Construction Materials List of U. L. Copy of this book may be obtained by applying to Underwriters' Laboratories, Inc., 161 Sixth Avenue, New York 13, New York.

Questions concerning conductors are fully covered in NFPA Standard No. 78. The material used, form and size, joints, fasteners, size, etc. are specifically covered. The standard recognizes aluminum but cautions with respect to the manner of use. In the absence of any specific question, it would be impracticable to cover the many details involved, but we believe that if you obtain a copy of NFPA No. 78 and also the U. L. Construction Materials List you will find the information desired.

Insofar as the N. E. Code is concerned the following Sections concern Lightning Arresters and Lightning Rods:

- Lightning Arresters—Article 280
- Lightning Arresters—Grounding—Section 2631
- Lightning Arresters—Radio Equipment—Section 8141 and 8142
- Lightning Arresters—Services over 600 volts—Section 2391
- Lightning Rods, As a Ground—Section 2586
- Lightning Rods, Spacing from conductor and enclosures and equipment. Section 2534, 2546.

Section 2586 of the Code prohibits the grounding of an interior wiring system or equipment to lightning rod conductors or the electrode used to ground the lightning rod installation. There is no restriction with respect to the space between the lightning electrode and the wiring system electrode and they may be bonded together if desired.

Section 2534 requires metal enclosures for conductors, wherever practicable, to be kept at least 6 ft away from lightning rod conductors, and when it is not practicable to secure the 6-ft separation, they shall be bonded together. As an example, a metal conduit service riser should be kept 6 ft away from the lightning rod conductor. Section 2546 is a similar provision which concerns metal frames and cases of electrical equipment which also must be kept 6 ft away from the lightning rod conductor.—B.A.McD.

More Than One Set of Service Entrance Conductors

Q. *Is it permissible to install two or more sets of service entrance conductors of the same voltage and phase in the switch room?—W.H.J.*

A. Yes. There are several cases where this is permitted.

First off in the case of load requirements it may be necessary to have parallel service entrance conductors, each having conductors larger than 1/0 in individual conduits or in the same raceway, feeding a single switch.

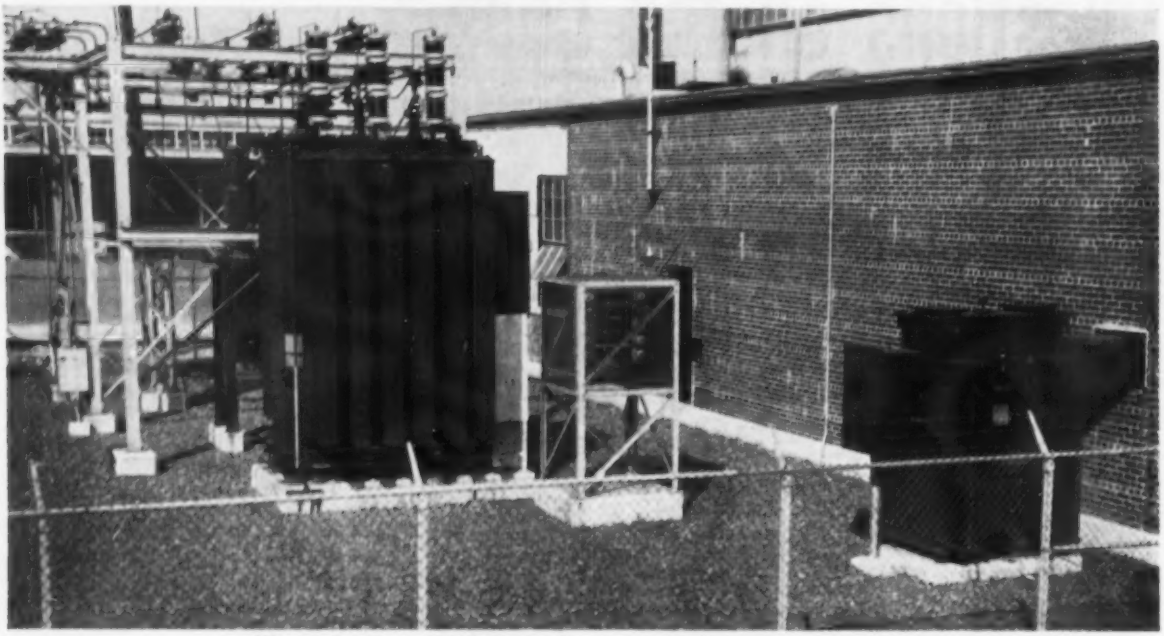
The requirements of the public utility may be such as to require two or more meters for different classes of service which may be served from the same voltage and phase system. For example, an "off-peak" 3-wire, 120/240 volt, single-phase service for a hot water heater and a standard service of the same rating for the balance of the load in the residence.

In a multiple occupancy building it is necessary to install more than one set of service entrance conductors.

There may be other examples but the above will serve to illustrate the answer.—B.Z.S.

Wiring for a School

Q. *Plans are now under way in this city to build an extensive addition to one of our existing high school buildings. The present building is about 250 ft long by 75 ft in width, and the new addition will be about 400 ft long by 70 ft wide and will be attached at right angles to one end of the present building. The service to the existing building enters the building at the far end from which the new addition will extend. As this present building is comparatively new, the existing service is adequate but, of course, does not have sufficient capacity to supply the proposed addition; and we do not think it would be practical to run feeders from this present service location to a point between 450 and 500 ft away in order to reach a midpoint of the new addition. Would it therefore be a Code violation to bring a new service drop to a midpoint in this proposed new addition and serve just that portion of the building from this new service, leaving the present service*



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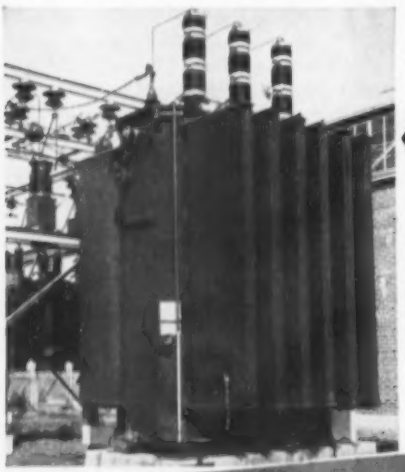

This 7500 kva Wagner Power Transformer supplies power for Air Reduction's Riverton, N. J. plant.

The 1000 kva Wagner Unit Substation Transformer steps down to 480 volts for distribution in the plant.

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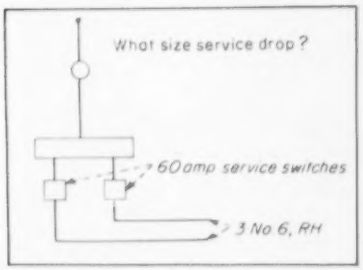
intact supplying the old portion of the building?—H.A.P.

A. Under Section 2321, paragraph d. you will note permission is granted to inspection authorities having jurisdiction where they see fit to permit more than a single service drop to a single building where that building is of unusually large area. This is no longer an uncommon practice as a considerable number of the larger area buildings are today being supplied by more than a single set of services located at opposite ends or sides of a single building. It is, of course, also true that many large area buildings are being supplied by primary service with two or more transformer banks scattered throughout the building. In your case we would suggest you contact the local inspection authority and discuss with him your proposal of a second service and the economies which the school district can benefit by through such an additional service, as he is the only person who can determine whether or not the Code permits more than a single service to the building in question.—G.R.

Size of Service Conductors

Q. *What size of service conductors are required for the service diagrammed?—E.W.H.*



A. Section 2304 states the requirements for the size of service conductors (i.e., service entrance conductors, 2304a; service drops, 2304b).

Basically, the code requires, in 2304a, a minimum size of No. 6 for the service entrance conductors. The service entrance conductors in the above diagram split into two "subsets" of service entrance conductors from a single set of main service entrance conductors. So it would seem, based only on Code requirements, this single main section of the service entrance con-

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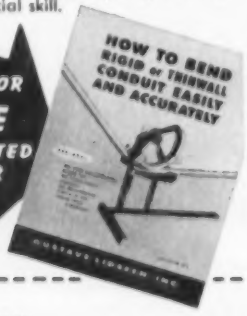

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ductors would also only have to be No. 6.

For the service drop, the minimum size required by 2304b would be No. 10 or No. 12, respectively, for soft copper and for medium or hard drawn copper.

However, it should be noted that the general paragraph heading Section 2304 requires "Service conductors (both the drop and entrance conductors) shall have adequate current-carrying capacity to safely conduct the current for the loads supplied without a temperature rise detrimental to the insulating covering of the conductors. . . ." So in effect, if the load is expected to exceed the minimum values, then the service conductors shall be increased to insure sufficient current carrying capacity.

In this case it would seem that more than average loading is being expected since we are using disconnecting means rated far in excess of the minimum required (Section 2357 requires 60 amps minimum for a switch). In this installation, which seems to be for a single occupant, we are installing 120 amps of disconnecting switch capacity. On this basis I would say that both the main service entrance section and the drop should be larger than the minimum.

How much larger is the question. You do not state just what the two subdivisions of load are. There is a possibility of some diversity, in which case the current carrying capacity may be anywhere from 60 amps up to the maximum of 120 amps. If motor load is involved, it is quite possible that even greater capacity (more than 120 amps) would be required, but in this case the use of No. 6 feeders in both lines would preclude the need for such larger main service entrance conductors.

As an inspector, based on this general requirement of the main paragraph of 2304 and not having any more information than shown above for the load, I would be inclined to require at least 120 amps capacity in the main service entrance conductors section, i.e., three No. 1 RH in 1½-in. conduit.

As far as the service drop is concerned the Utility Co. would more or less assume the responsibility for this. In most instances Utility companies install minimum size service drops larger than the minimum required by 2304b. In any event they would size their drop to insure adequate service, most probably using No. 4 Type RH, for example.—B.Z.S.

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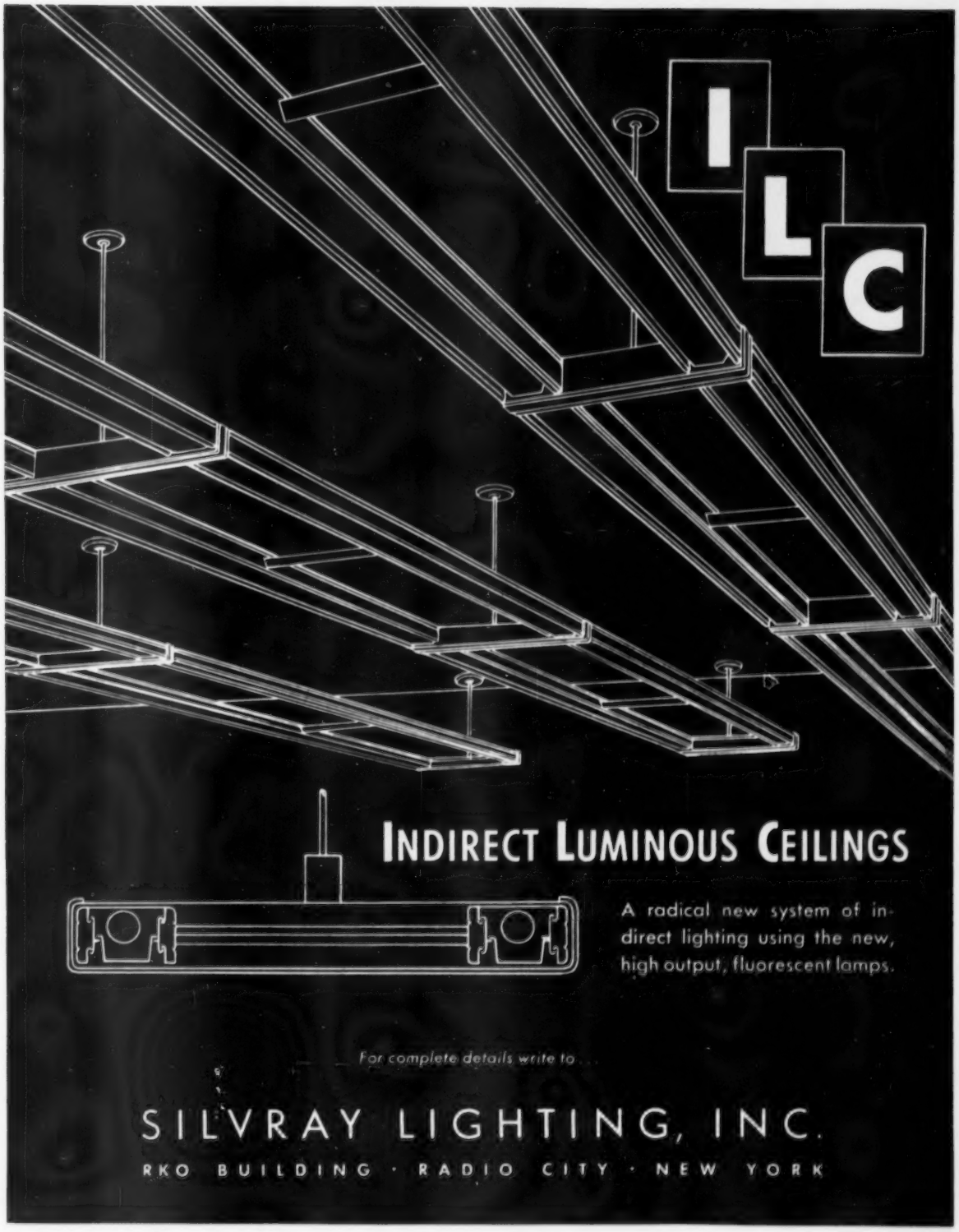
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Punch Press Motors

Q. *Have you any suggestions for protection of 3 and 5 hp, 220-volt, 3-phase motors driving punch presses? Proper sized thermal overload switches "kick-out" and dual element fuses, sized properly, blow out. Motors on presses are barely warm to the touch.—P.P.G.*

A. Punch press motor applications usually involve the use of motors with special characteristics and controllers that are suitable for the duty involved. Ordinarily motors with the usual protective devices would not function properly. With a fluctuating flywheel load there will be a tendency for the motor to slow down which may be retarded when a motor with suitable "slip" characteristics is used. I personally believe that a thermal relay with suitable lag characteristics would eliminate the trouble you have experienced. I would suggest however that you contact the motor manufacturer and request that he advise the type of motor and controller to be used for a given application.—B.A.McD.

Wiring for a Garage

Q. *Is it always necessary in the wiring of a basement of a garage to use only explosion-proof electrical wiring equipment and materials.—C.A.M.*

A. No, it is not always necessary to use explosion-proof Class 1, Group D or to consider all of such area as a Class 1 Division 2 location, inasmuch as you will note in paragraph b2 following Section 5105 the following wording:

"For each floor below grade, the entire area up to a level 18 in. above the bottom of outside doors or other openings which are at or above grade level shall be considered to be Class 1, Division 2 location. Where adequate positive-pressure ventilation is provided, the authority enforcing the Code may judge that the hazardous location extends up to a level of only 18 in. above each such floor."

At the present time standards for garages specify that adequate ventilation shall consist of 1 cu ft being removed from the building for each 1 sq ft of floor area of each floor and I might add that the new proposed standards now being

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formulated are reducing this to ⅓ of a cubic foot of air for each square foot of floor area. Therefore, in a garage in which positive ventilation was in operation which would assure the removal of at least ⅓ of a cubic foot of air for each square foot of the floor area for floors below grade, ordinary electrical wiring and apparatus could be installed if kept 18 in. or more above that floor level.—G.R.

Computing Service Conductor Capacity

Q. *Recently we changed the service in an old three-family house using three 100-amp meter troughs and a 100 amp, 120-240-volt single-phase panel for each apartment. We fed the first meter with 3/0 RH. From there we used 1/0 RH to feed the remaining two meters. The inspector claims 3/0 is not large enough for three apartments.—P.E.P.*

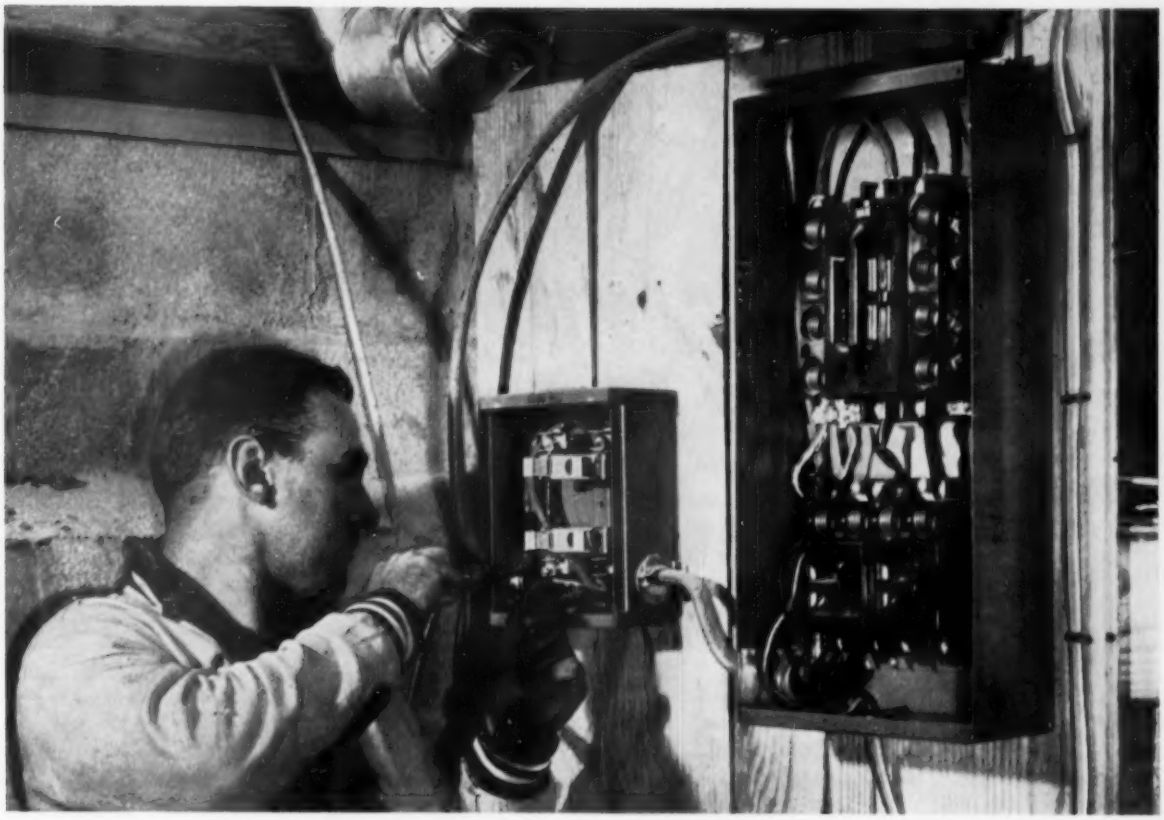
A. In the absence of any detail with respect to the loads to be served, it is impossible to answer your question. A 3/0 RH conductor has a current-carrying capacity of 200 amps and a 1/0 RH conductor has a capacity of 150 amps. What is the square foot floor area of the apartments? Do they have electric ranges and water heaters? Do they have air conditioning units or are they heated electrically? Are there electrical appliances other than those ordinarily used on the appliance circuit that must be installed in each apartment? These are the questions which must be answered before any comment may be given with respect to the size of the service entrance conductors.—B.A.McD.

Motor Disconnect and Control Wires

Q. *In several cases it is necessary to run control and interlock wires from an air conditioning unit through its disconnecting means back to equipment for the pump. In most of our present switch enclosures does this conflict with Article 3737b?—S.J.W.*

A. Section 4307 is a corollary rule to 3737b applying specifically to motors.

Right off hand I would say the



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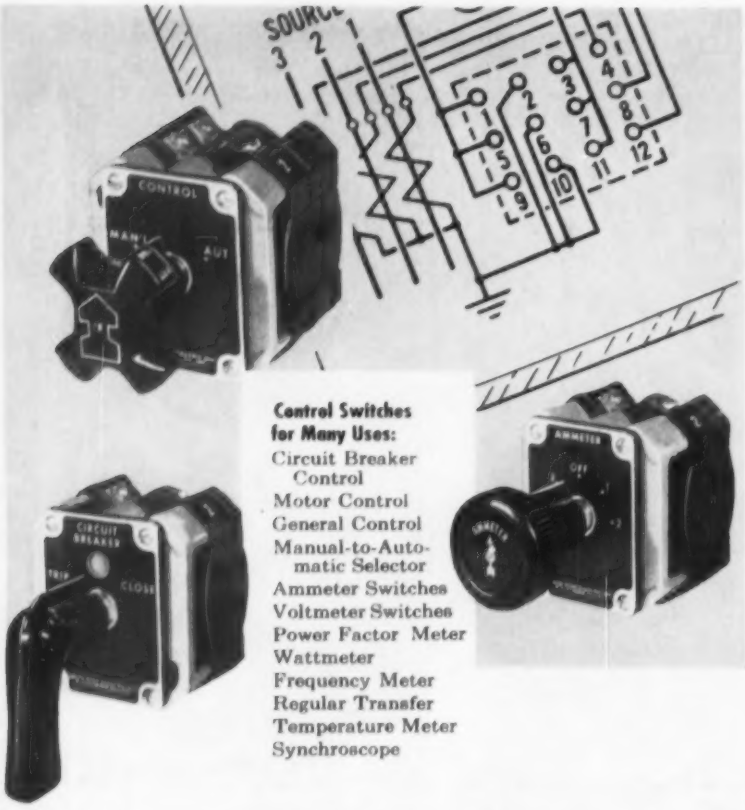

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Need rugged Control Switches? See Delta-Star's new line

These new Type M-2 Delta-Star control switches designed for D.C. or A.C. service give you important new features that mean improved operating efficiency and economy.

1. **Versatility**—designed for many uses from motor controls to synchroscopes. Switches are rated 20 amps. continuous rating with 250 amp. three-second rating.
2. **Compactness**—only 3⅞ in. high by 3¼ in. wide; new design permits easy wiring, quick inspection.
3. **Rugged and long-lasting**—heavy duty parts; high Delta-Star quality construction.
4. **High interrupting capacity**—single break contacts rated 25 amps. at 250 volts a.c., double break rated 75 amps.

Delta-Star now offers premium control switches at regular prices. Ask your Delta-Star representative about them or write *Delta-Star Electric Division, H. K. Porter Company, Inc., Chicago 12, Illinois. District offices in principal cities.*

HKP DELTA-STAR ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.

construction you outline is a violation. It would seem that the various connections for the control circuit could just as well be made in the controller itself. While 4307 applies to the controller enclosure, it is generally accepted practice to permit additional conduit lines and additional taps, etc., since these are of necessity required within the controller unit to permit proper operation of the circuits.—B.Z.S.

Flexible Conduit

Q. *We have just completed a rather large installation of coal conveying equipment in which the motors driving the coal conveyors are supplied through short lengths of flexible conduit. The inspector refused to accept this installation saying that flexible conduit cannot be used in areas subject to coal dust. We understand this is correct if the atmospere were filled with metallic dust but we cannot find any provision in the Code which classes coal dust as conductive. Is this inspector correct?—J.J.*

A. In the second fine print note following paragraph 5005a of the Code, you will note the last sentence reads as follows:

"Electrically conducting nonmetallic dusts will include dusts from pulverized coal, coke and charcoal. Metallic dusts from magnesium, aluminum and aluminum bronze are particularly hazardous, and every precaution must be taken to avoid ignition and explosion."

Then under paragraph 5054a 2 you will find the following:

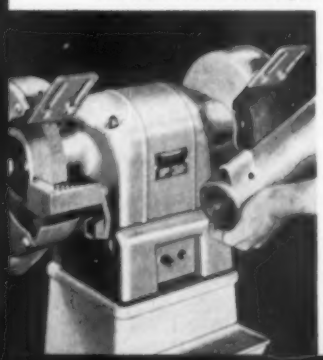
"Where necessary to employ flexible connections, dust-tight flexible connectors, flexible metal conduit with approved fittings, or flexible cord approved for extra hard usage and provided with bushed fittings shall be used, except that where dusts are of an electrically conducting nature, flexible metal conduit shall not be used, and flexible cords shall be provided with dust-tight seals at both ends. An additional conductor for grounding shall be provided in the flexible cord unless other acceptable means of grounding is provided. Where flexible connections are subject to oil or other corrosive conditions, the insulation of the conductors shall be of a type approved for the condition or shall be protected by means of a suitable sheath."

Four models...one tailor-made for your work!

PUSH-BUTTON SAFETY SWITCH! 2 pole push-button switch is recessed for your protection, but is easily accessible.

ADJUSTABLE U-SHAPED TOOL REST: Gives full support. Can be adjusted for wheel wear. Perforations stop dirt accumulation.

4 VERSATILE MODELS, 4 POWERFUL MOTORS! 6" through 10" wheel diameters. From ¼ to 1 hp. Each has additional advantages.



DRILLS

VACUUM CLEANERS

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HAMMERS

Look Under "TOOLS-ELECTRIC" in Yellow Pages

Smooth-running Black & Decker Bench Grinders are POWER-BUILT for continuous peak performance!

Choose one of the four Black & Decker Bench Grinders and you're sure to get top quality tool sharpening, wire brushing, grinding, buffing.

The smooth-running Black & Decker-built motor is designed to give constant speed, regardless of load. Extends life of wheel, causes less overheating. Lubricant-sealed ball bearings protect against abrasive damage. Adjustable tool rests, adjustable spark shields, and built-in exhaust outlets make for safer, easier operation.

Call your distributor for a free demonstration today. For a free catalog write to: THE BLACK & DECKER MFG. CO., Dept. 2303, Towson 4, Md. (In Canada: 80-86 Fleet St., E., Toronto 2, Ont.)

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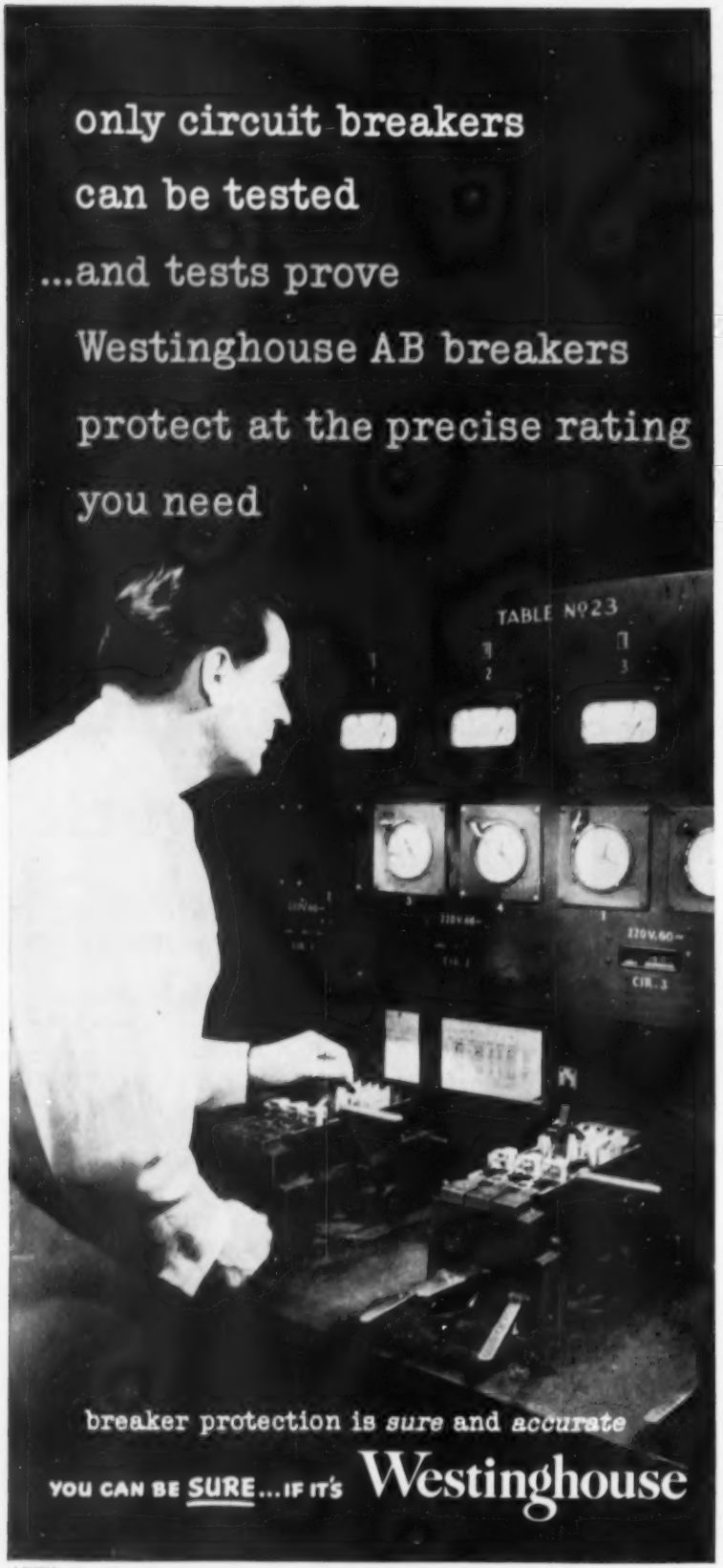
B&D **Black & Decker**®

Portable Electric Tools—Power-Built to Last



If you will refer to Article 351 covering Liquid-Tight Flexible Metal Conduit, you will note under Section 3512, paragraph b, the following statement:

"Liquid-tight flexible metal conduit shall not be used under the following conditions: In any hazardous area except as described in 5014-b, 5054, and 5073 of Article 500, unless it is specially approved for such use."

Inasmuch as it states it may be used under Section 5054, it would then be possible to substitute for the present flexible conduit you now employ either the cord described under 5054 or the liquid-tight flexible metal conduit.—G.R.

Feeder Disconnect Switch

Q. *In Section 2351-d, it is stated that a disconnect may be located adjacent to the building. With respect to the word "adjacent" would a switch located in a switchboard in a building 300 ft away meet these conditions? (It is readily accessible with regards to access to building etc.)—F.D.*

A. Official Interpretation No. 313, issued 12/10/48 clarifies the intent of Section 2351-d. It reads as follows:

Question: With respect to a garage, is it necessary to construe the term "adjacent to the building" of paragraph d of Section 2351 so as to prevent placing the disconnecting means at the house instead of at a detached garage on the same premises?

Finding: No, the intent was to follow the practice specified in the 1940 edition of the Code.

This question was covered by Section 2306 of the 1940 edition of the Code. At that time a feeder to a building served through a master service must be controlled by a switch or circuit-breaker located in the building served or in another building provided it is accessible to the persons using the installation. The matter of distance is not covered by the Code and it therefore becomes the responsibility of the Inspector to decide if a switch located in another building 300, 500, 1000 ft or more from the building served is a readily accessible means of disconnect. Personally I am inclined to believe that a readily accessible switch located in the building served is desirable regardless of the distance.—B.A.McD.

WHAT?
AB-I's cost less than safety switches?
YES!
In many cases Westinghouse AB-I circuit breakers do. And check the other concrete benefits that safety switches can't match.
You realize definite reductions in wiring costs: because the enclosure is installed first and unit breaker wired later, there is no obstruction to pulling wires. At the present-day electrician's rate of pay, this adds up to real dollar savings.
In order not to tie up your capital until breakers are actually needed on a job, you may purchase the enclosure only. Westinghouse unit breakers are sold separately for your convenience.
Don't these reasons prove to you that Westinghouse AB-I breakers are today's best circuit protection buy?
J-30222
WATCH WESTINGHOUSE!
WHERE BIG THINGS ARE HAPPENING FOR YOU!

SPECIFY QUALITY . .

insist on *Levolier*® switches

Only McGILL makes *Levolier*® switches

— and only Levolier switches give you the degree of quality that has earned them the reputation of being the most dependable switches ever built. Material selected for extra quality includes heavy special alloy copper or silver for contacts and all switches are pre-lubricated with highly refined plastic petroleum. Completed switches are 100% factory tested and eliminate costly replacement.

Levolier switches are designed for fast, economical installation with self-insulating molded phenolic cases. .75 to 20 amps. All are Underwriters Laboratories Inspected.

No. 71 single-pole single circuit, universal pull lever switch . . . the thinnest 6 amp. "T" 125 volt—3 amp. 250 volt switch of its kind on the market today—only 15/32" thick. Also with push button.

No. 1010 single-pole, single circuit lever switch for high-watt lamps and fluorescent banks. Universal pull lever control. 10 amp. 125 volt.

No. 25 toggle switch carries a 6 amp. "T", 125 volt, 3 amp., 250 volt rating with a S. P. S. T. double-break mechanism. 1/3 H.P. A.C. 120-240 volt. Ideal for panel board, F.H.P. motors, appliances, power tools, etc. Also with push button control.

No. 90 ¾ H.P. capacity, 15 amp. 125 volt, 10 amp. 250 volt toggle switch with a single - pole, single-throw mechanism. Designed for AC operation. Also available in two circuit with center off and no off.

No. 29 single - circuit, .75 amp., 125 volt momentary contact switch. Excellent for automatic control of lights as in door openings and closings. Also 4 amp. Available 15 amp., for limit and safety control of industrial machinery operations.

No. 41 single-pole, single-circuit, universal lever switch. 6 amp. "T", 125 volt—3 amp. 250 volt. Only 5/8" thick, it is ideal for conduit box and canopy mounting for lighting and for FHP motor control.

FREE! For complete details on McGill switches, sockets, lampguards and other electrical specialties, write for catalog #84.

Available from your electrical wholesaler.

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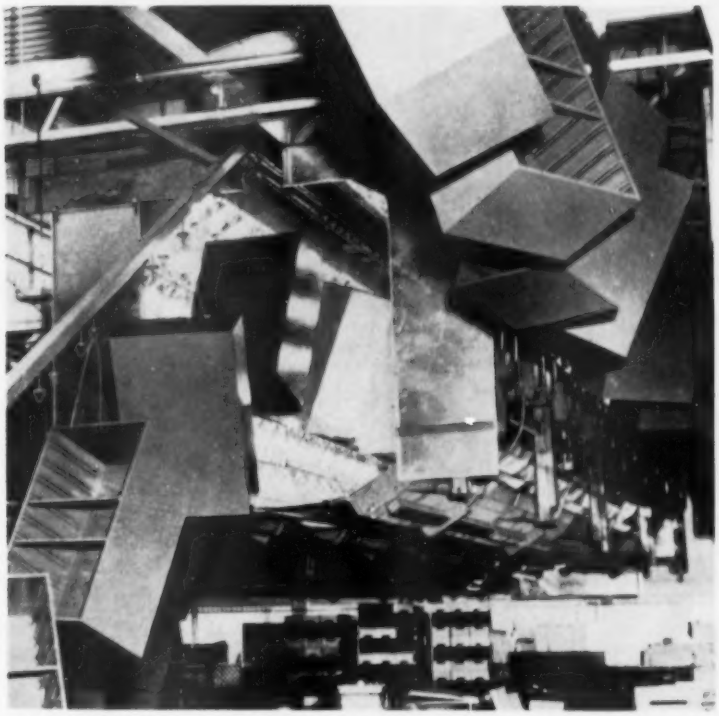
are always a little better and ***ALL*** *are Underwriters Laboratories Inspected*

McGILL MANUFACTURING COMPANY, INC. **450 N. Campbell St., Valparaiso, Indiana**

Practical Methods



ELECTRIC HEAT is provided by this infrared oven, mounted up out of the way and used for baking the paint finish on metal office equipment in new one-story plant.

Ceiling-Mounted Radiant Ovens

INDUSTRIAL HEATING

Two compact, pre-engineered electric radiant heating ovens suspended from the ceiling are part of the highly efficient, conveyorized painting and baking system installed in the new one-story plant of The Wright Line, Inc., Manufacturing Division, Worcester, Mass. The firm makes a full line of metal office equipment for the handling, filing and transporting of punched tabulating cards, and is now completing an extensive expansion program. The radiant heating equipment, designed and manufactured by The Fostoria Pressed Steel Corporation, Fostoria, Ohio, consists of 28½-ft infrared-lamp ovens with 5 ft by 6 ft tunnel openings, carefully integrated into Wright's automated finishing, assembling and shipping operations.

After a unique "fine-wrinkle" finish is applied to the various units they are conveyed ceiling-ward to pass through the overhead infrared ovens. Revolving slowly, they emerge from the ovens within 21½ minutes, with a uniform one-coat baked wrinkle finish which is one of the distinguishing features of the modern Wright line. The oven units operate at a carefully controlled 365° F temperature. Still suspended from the monorail conveyor, the finished units—completely dry and ready to be assembled and packed—are transported to the shipping area.

Officials of the company estimate an invaluable amount of floor space has been gained by suspending the radiant ovens from the ceiling—a far-sighted move which also resulted in an uninterrupted flow of work and continuous freedom of movement through aisles.

H-V Aerial Cable Makes A Trim Primary Service

WIRING

A dual-fed, 12,000-volt, overhead line serving the electrical needs of the Cermak Plaza Shopping Center in Berwyn, Ill., presents an interesting departure from conventional design. By using a 3-conductor aerial cable, 3-phase oil-cooled transformers and pole-mounted sectionalizing oil switches, Public Service Company of Northern Illinois engineers have combined trim appearance with on-the-site switching flexibility. Gone is the usual clutter of insulator-studded crossarms with parallel conductors and large, multiple-transformer platforms. In its place is a sleek, single-cable line with compact, load-break, oil-switches at each pole where a lateral branches off to feed a simplified, two-pole transformer structure.

The overhead primary runs along two sides of the rectangular shopping center area, behind the buildings and near the property line. It is a 3-conductor, 15-kv, paper-insulated, lead covered, Neoprene jacketed cable messenger-supported between poles. Along its course, the primary line feeds six 12,000/120/208-volt, 3-phase, oil-cooled transformers. Four of these are 500-kva units. Two are 750-kva size. All transformers but one are mounted on a two-pole structure adjacent to a building wall. The exception is roof-mounted on a building at east end of center.

Two separate utility circuits feed the primary line. One is at the east end of the property, the other at the west end. At present,

SECTIONALIZING OIL SWITCH is mounted on pole opposite transformer structure. Primary line goes straight through; lateral to transformer comes out top. Switch levers on pole can be positioned to isolate transformer, switch transformer from one primary circuit to the other, or isolate any section of the line.

G-E Hook-on Volt-Ammeter Helps Avoid Reading Errors

RANGE AND SCALE of this G-E instrument show simultaneously by simply turning the fingertip control knob. Seeing only one range and scale avoids reading errors.

SCREW-IN VOLTAGE LEADS and recessed terminals provide maximum protection for the operator. Voltage leads cannot be pulled out accidentally.

WIDE RANGES ARE AVAILABLE in both models of the G-E hook-on volt-ammeter. Ranges of the AK-4 model are 0-10/30/100/300/800 amperes and 0-150/300/750 volts. The AK-5 ranges are 0-5/20/80/-350 amperes and 0-150/300/750 volts. The wider range AK-4 model has a pointer-stop for accurate checking of surge readings.

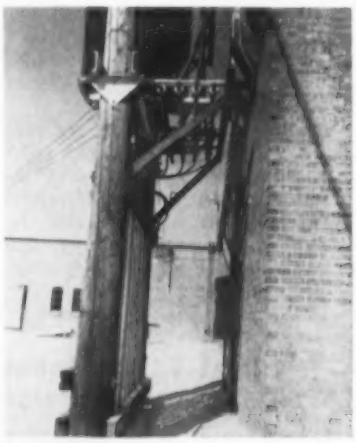
FOR FURTHER INFORMATION, write Section 582-20, General Electric Co., Schenectady 5, New York and ask for bulletin GEA-6292, or contact your nearest G-E Apparatus Sales Office or Distributor.

Progress Is Our Most Important Product

GENERAL ELECTRIC

AERIAL CABLE provides trim primary, dual-fed, overhead service to a shopping center. Pole at right is one of two separate utility circuit feeds. Incoming line goes under driveway to road. Note pothead termination of aerial cable.

3-PHASE TRANSFORMERS simplify two-pole transformer structures. Units range from 500 to 750 kva. Primary lateral at top terminates at sectionalizing switch on 12,000-volt pole line. Seven secondary feeders originate at transformer.



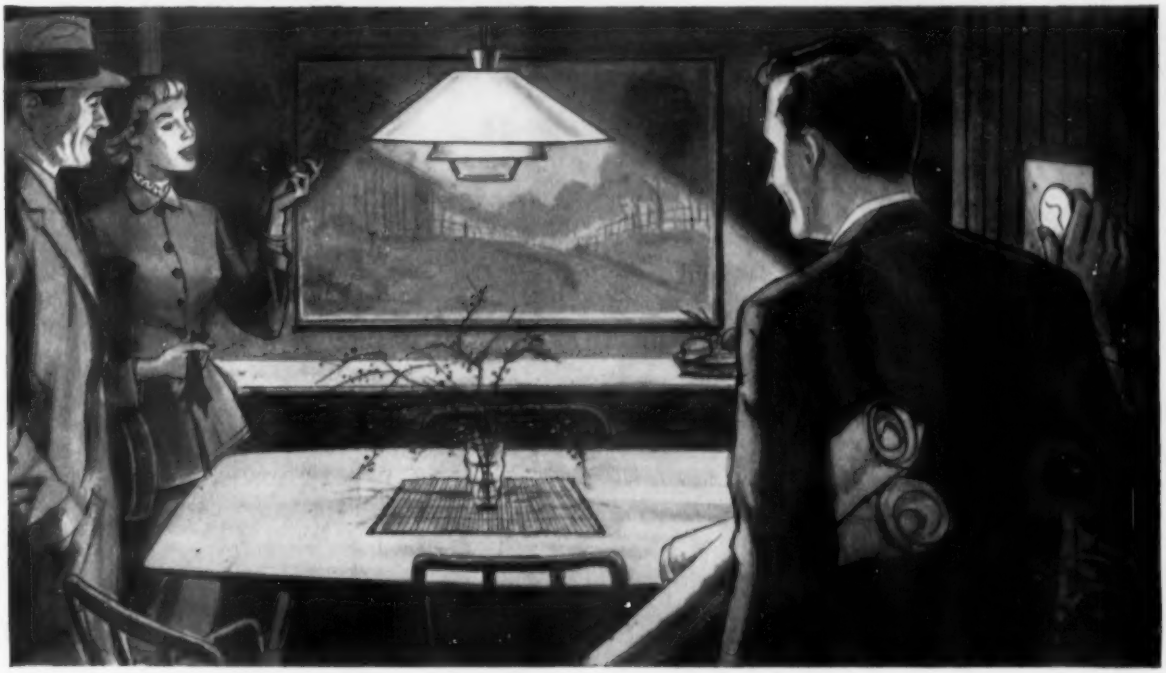
SECONDARY RACK under 3-phase transformer consists of four lengths of 2,000-MCM insulated cable on split-porcelain insulators. Seven 120/208-volt feeders go underground from pole structure to store locations.

the line is "cut" at one of the sectionalizing switches and three transformers are fed from each circuit. This arrangement can be quickly changed when conditions warrant. Any number or all of the transformers can be fed by either circuit by simply changing the position of the switch handles.

An unusual degree of operating flexibility is provided by these sectionalizing switches mounted on poles opposite transformer structures. Aerial cable laterals from the transformer primaries terminate at the top of a 400-amp, 15-kv, oil switch mounted on a short crossarm structure on the pole. The dual-fed 12,000-volt primary line enters one side of this switch and leaves the other side.

Each switch has two rod-connected operating levers mounted about 10 ft above the ground. Each handle can be locked in one of four positions: "ground", "on", "off" and "transformer by-pass". When both levers are in the "on" position, the transformer lateral is energized and the primary line continuity is maintained. If one is "on" and one "off" the transformer is still energized from one end of the dual feed, but the line continuity is cut at this pole. If both handles are in the "by-pass" position, line continuity is maintained, but the transformer lateral is "dead". With this arrangement, it is possible to isolate each transformer and still have the line energized; or cut the line at any switch location; or isolate any section of the primary line without interrupting customer service.

The electrical system was installed by Berry Electric Co., electrical contractors of Chicago, Ill.



"...most talked-about feature!" "...fascinates home-buyers!" "...helps sell new homes!" —that's what builders are saying about the profitable new LUXTROL Light Control

From all parts of the country, builders write that LUXTROL is making a big hit with home-buyers . . .

Hillcrest Lumber Company, De Pere, Wisconsin "...LUXTROL is the most talked-about feature of the Better Homes & Gardens Idea Home. ...people never thought it possible that light could create such decorative effects!"

Rolling Ridge Homes, Northport Village, Long Island ". . . prospective buyers are most fascinated by LUXTROL. They love the idea of dialing any degree of light they want—from a dim glow to complete brightness! . . . really helping to merchandise houses!"

Ernest Widmer, Builder, Daytona Beach, Florida "LUXTROL Light Controls help sell homes because they're trouble-free, economical to purchase and operate, and they provide easy selection of light levels for any occasion . . ."

H. C. Roberts & Sons, Anaheim, California "Our Electri-Living Home includes all the latest products... the unequalled flexibility of light provided by LUXTROL is definitely outstanding. It gives the homeowners light for every mood and every seeing need."

Sell LUXTROL as an exciting extra to the profitable new-home market

LUXTROL shows off your customers' new homes in their *best light*. It adds that final, ultra-modern touch that home-buyers really go for!

You can recommend LUXTROL for any type of building. For fluorescent, incandescent, or cold-cathode lighting. Easy to install — simply replaces ordinary wall switches. Safe — a precision-built, cool operating auto-transformer, not a rheostat.

The moderate cost of LUXTROL makes it a natural for homes in *every* price range. Mail the coupon *today*.

new LUXTROL light control

A product of THE SUPERIOR ELECTRIC COMPANY

THE SUPERIOR ELECTRIC COMPANY
14037 Demers Avenue, Bristol, Connecticut
Send me literature and where to get delivery of new LUXTROL *Light Control.*

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Company_____
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City_____ Zone____ State_____

"RAWLPLUG MASONRY ANCHORS NEVER LET GO!"...

Says USER for over 18 years

Using a ⅝" drill Millwright bores 3¼" deep hole
He inserts ½" Rawlplug into hole
½" lag screw is placed through each leg into Rawlplug
Completely lagged roller-bearing tumbler ready for use

RAWLPLUGS USED TO LAG MACHINES IN LARGE NEW JERSEY INDUSTRIAL PLANT (Name on request)

Millwright Leonard Gillis states: "I've been at this plant 18½ years and have been using Rawlplugs since I started here. I understand that the fellows before me were using Rawlplugs. I use about 20 or 25 Rawlplugs a day for lagging. I find them very simple to use. A smaller hole is drilled, making the job faster and easier. The tumbler which I just lagged is used for polishing and de-burring. It vibrates constantly when in use, but Rawlplugs will not let go.

Some heavy presses were lagged with Rawlplugs about eight years ago, and they are still holding firm.

We also use Rawlplugs to set up quick angle iron braces to hook up a block and tackle when moving heavy presses. As long as I've been using Rawlplugs, I've never had one let go."

Pocket Gauge A Handy Tool

TOOLS

Contractor ingenuity can often transform a small, simple gadget into a handy field tool. Convincing proof of this is evident in the construction activities of Brooker Electric Company, a Detroit electrical construction firm.

One item that attracted considerable attention during the electrical installation at the recently completed Briggs multi-million dollar Beautyware Plant on Detroit's outskirts was a simple, pocket-size gauge that lent itself to diverse application. The unit is made of heavy-gauge stainless steel; is 4½ in. long; weighs only two ounces; and costs less than $2.00. Known as the Burndy "Wire-Mike", the gauge gives direct readings of

VERSATILE POCKET GAUGE is used extensively by Brooker Electric men in the field; gives direct reading of wire and conduit sizes; can be used as inside or outside calipers.

MATCHING LUGS and connectors to cable size with help of the pocket gauge. Here Brooker electrician W. J. Thomas installs Hydent lugs to switchboard leads after Supt. Fred Winskill checked sizes.

Make Bull Dog your Pet Tape!

There's a BULL DOG TAPE for every purpose

- **FRICTION**
- **RUBBER**
- **PLASTIC**

BULL DOG TAPE is a man's best friend! Delivers thoroughbred performance every time. It goes on fast . . . sticks tight and stays tight. Splices neatly . . . extra strong and non-ravelling. High dielectric strength for complete all-around electrical protection. BULL DOG is *tough*, too . . . resists weather and moisture . . . stands up longer on the job!

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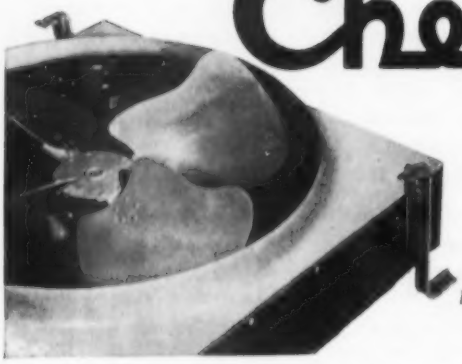
DON'T OVERLOOK CHELSEA FLOATING ACTION ATTIC FANS

Whether you're looking for minimum cost home cooling or a complete air conditioning installation — *don't overlook Chelsea attic fans!* . . . Completely practical for any home when used alone, attic fans used in conjunction with air conditioners increase cooling efficiency so tremendously that smaller, less expensive conditioning units can deliver specified performance . . . Now, join the ever increasing group of contractors and builders who have used Chelsea attic fans to increase both profits and sales appeal!



Chelsea

. . . Home cooling has become a "Sales Must"!

CHELSEA FAN & BLOWER CO., INC.
PLAINFIELD, NEW JERSEY
Fan Specialists for over 30 Years!

AD 59-21

CHECKING CONDUIT sizes on new shipment in field warehouse are (L to R) Arnold Viersma and Ralph Drake, Brooker foreman. More than 20 of these pocket gauges are in use on Brooker jobs.

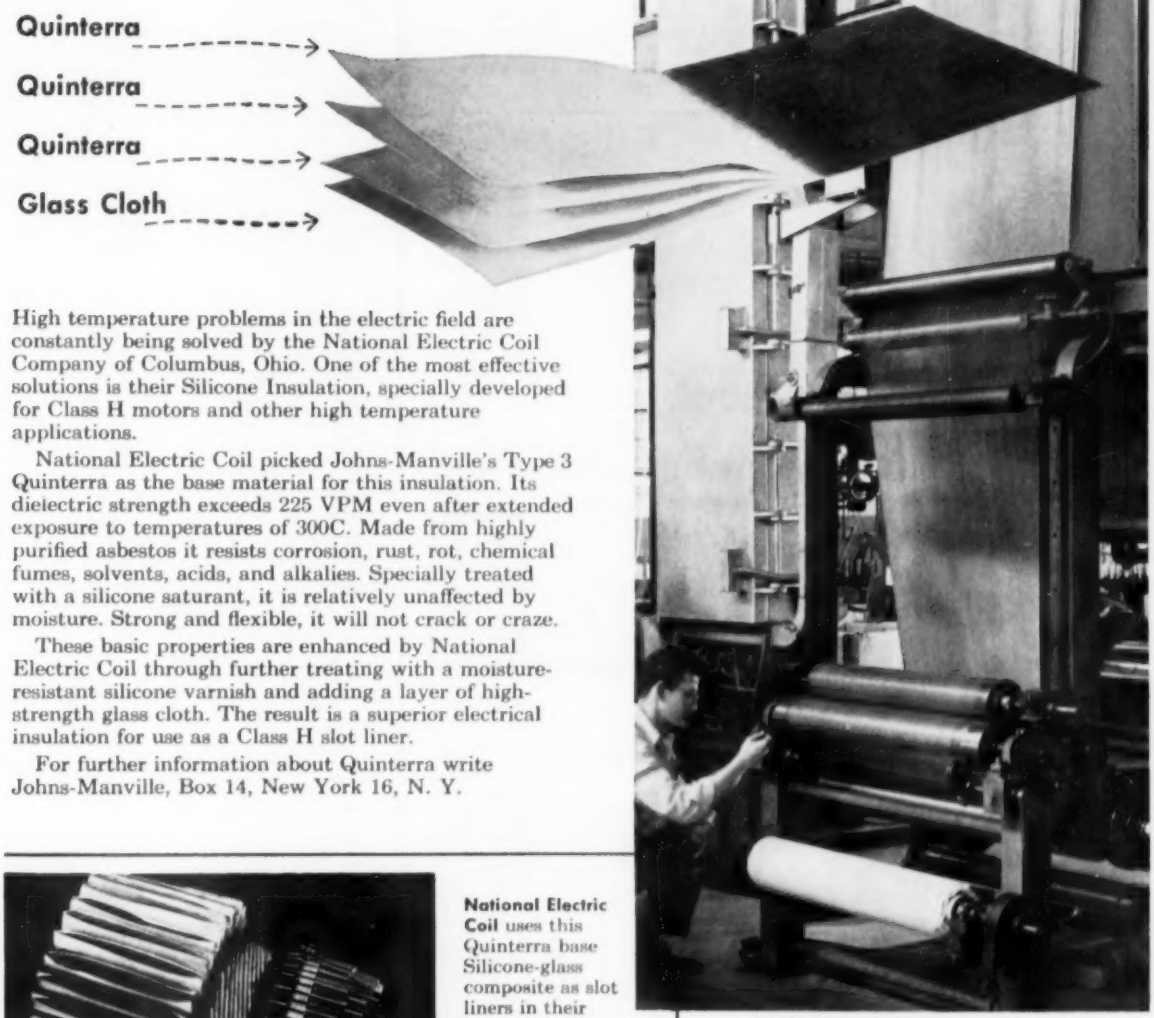
QUESTION OF underground conductor size in Briggs plant parking area is quickly resolved by simple check with handy pocket gauge. Brooker electrician T. F. Crawford watches while Supt. Winskill (right) uses the "mike".

cable size from No. 18 through 2,000 MCM for stranded conductor; from No. 20 through 4/0 for solid; and from No. 6 through 336.4 MCM for ASCR. In addition it gives visual indications of rigid conduit and copper pipe sizes from ¼-in. through 2½-in.; EMT from ½-in. through 2-in. The device also is an inch-rule and inside and outside caliper calibrated in 32nds of an inch and has a handy conversion table of pipe sizes to inside dimensions.

Although developed primarily as a wire gauge, the "Mike" was put to many uses by Brooker personnel on both the Briggs and other installations. Among them were the following: checking cable and conduit sizes in the job warehouses; making a similar check on installed items; and matching cable connectors to installed cable sizes. In fact, the compact pocket-tool was used extensively whenever hard-to-get measurements were necessary.

How National Electric Coil Co. uses J-M Quinterra®

to make their insulations resist higher temperatures



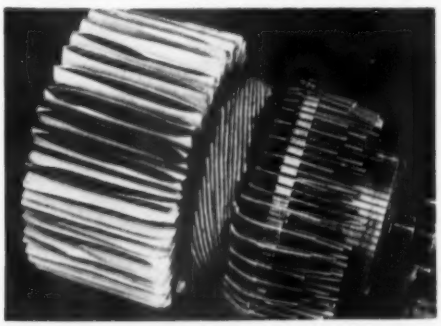
High temperature problems in the electric field are constantly being solved by the National Electric Coil Company of Columbus, Ohio. One of the most effective solutions is their Silicone Insulation, specially developed for Class H motors and other high temperature applications.

National Electric Coil picked Johns-Manville's Type 3 Quinterra as the base material for this insulation. Its dielectric strength exceeds 225 VPM even after extended exposure to temperatures of 300C. Made from highly purified asbestos it resists corrosion, rust, rot, chemical fumes, solvents, acids, and alkalies. Specially treated with a silicone saturant, it is relatively unaffected by moisture. Strong and flexible, it will not crack or craze.

These basic properties are enhanced by National Electric Coil through further treating with a moisture-resistant silicone varnish and adding a layer of high-strength glass cloth. The result is a superior electrical insulation for use as a Class H slot liner.

For further information about Quinterra write Johns-Manville, Box 14, New York 16, N. Y.

Roll of J-M Quinterra Type 3 is here being treated with silicone varnish at National Electric Coil plant.



National Electric Coil uses this Quinterra base Silicone-glass composite as slot liners in their extensive motor repair operations. It is also available to others as Catalog #8A343 from their Columbus, Ohio, factory.

Johns-Manville ELECTRICAL INSULATIONS

MADE OF PURIFIED ASBESTOS

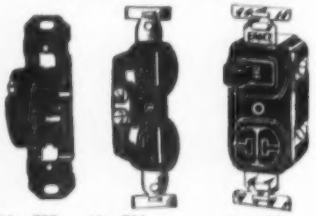
MOST COMPLETE LINE of QUALITY WIRING DEVICES

EAGLE

UP TO THE MINUTE MODERN ELECTRICAL DEVICES FOR EFFICIENT "RESIDENTIAL WIRING"
RATED NO. "1" FOR QUALITY, PRICE, EASE OF INSTALLATION

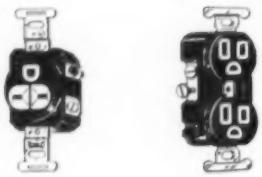
Eagle's four plants basically produce all materials and enjoy a 35 year reputation for keeping costs down to allow you greater profits. You'll eliminate service call-backs because of Eagle's outstanding record of trouble-free performance. One purchase order, one shipment and one invoice for all your wiring devices saves you time and handling costs, and affords better stock control.

SWITCHES and RECEPTACLES



No. 787 Toggle Switch
No. 736 Duplex Receptacle
No. 798 Combination Switch and Receptacle
(With screws mounted on straps)

3 WIRE "U" GROUND RECEPTACLES



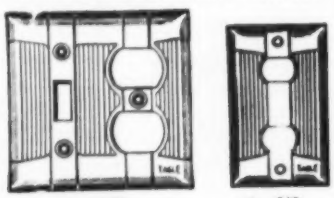
No. 816 Tandem Ground Single Receptacle
No. 827 Parallel Ground Duplex Receptacle
Above devices Available Both Single & Duplex
Also on 3¼" and 4" Metal Covers.

INTERCHANGE DEVICES

Interchangeable With All Standard Lines

No. 901 Single Pole Switch
No. 902 Power Receptacle

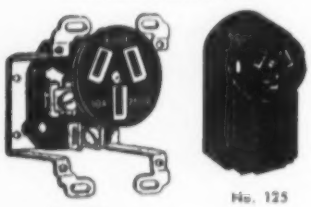
EAGALINE and INTERCHANGE PLATES



No. 138 Combination Plate
No. 952 2 Device Plate

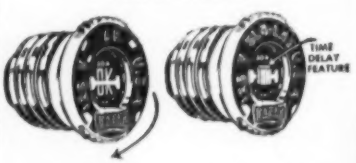
RANGE and DRYER RECEPTACLES

FLUSH & SURFACE TYPE



No. 122 Range Receptacle
No. 125 Dryer Receptacle

PLUG FUSES



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Guessing component sizes was eliminated and field errors commonly attributed to this cause were non-existent when the gauge was used.

On the Briggs project, and other jobs, Brooker is using some 20 of these handy pocket gauges obtained through one of its major electrical supply houses. At present the Brooker firm has about ten key project engineers and a field force ranging from 150 to 250 men. With installation efficiency a prime consideration, Brooker management is constantly seeking time-saving ideas and equipment items that will enable its crews to do a better, more economical job for the customer.

Diamond Bits Cut Slab Drilling Time

TOOLS

To keep costs per square foot to a minimum, the new Ford Motor Company administration building in Dearborn, Mich., was constructed on a production line basis. Unconventional techniques were used in many instances to streamline construction. The electrical installation was no exception and Harlan Electric Co., project electrical contractor, applied the latest in power-driven tools to meet the specific conditions encountered.

Typical of Harlan's mechanized approach to field problems was a technique developed to install some 8,400 electrical and inter-com outlets in the cellular steel floors of the 12-story structure. Due to the construction pattern followed, outlet installation followed erection of office partitions and setting of office furniture. In general, the steel Robertson Q-floor was topped with a 3½-in. layer of concrete. Then an entire, clear floor up to 50,000 sq ft in area was covered with rubber tile. This streamlined approach eliminated cutting and fitting of rubber tile sections around outlets and other obstacles. Erection of glass office partitions came next and finally spotting of office furniture. Only then did the electrical contractor start his outlet installation.

Biggest problem facing Harlan mechanics was that of cutting 2½-in. holes through the tile and concrete cap to reach the steel cells of the subfloor without disturbing already occupied offices and without damaging the finished floor surfaces. Harlan's vice-president in charge of construction, H. O. Krip-

No Storage Problem Here!

Only Allis-Chalmers low voltage switchgear permits convenient storing of breaker in its own compartment with door closed!

To give space needed when breaker is in disconnected position, center panel is reversed by simply loosening four knurled nuts. No tools are needed.

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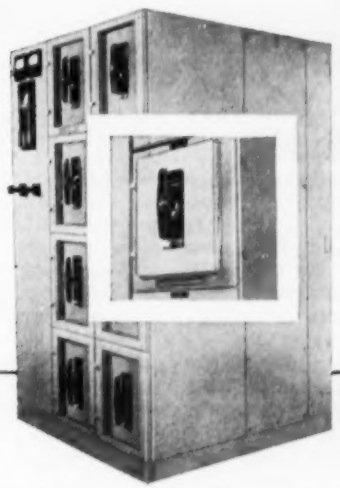
This means no special storage space is required for breakers not in use. Handling and danger of damage during movement of breakers are eliminated.

As long as breaker is in compartment it is always firmly fastened to withdrawal mechanism and can't make contact accidentally.



Get the complete story!

There are many other desirable features in Allis-Chalmers low voltage switchgear. For details call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

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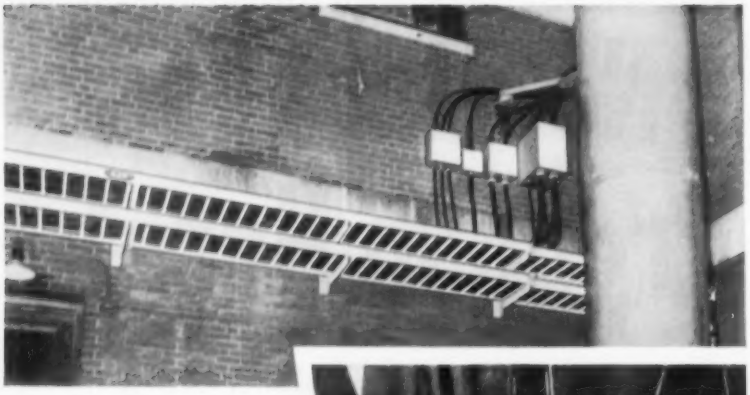

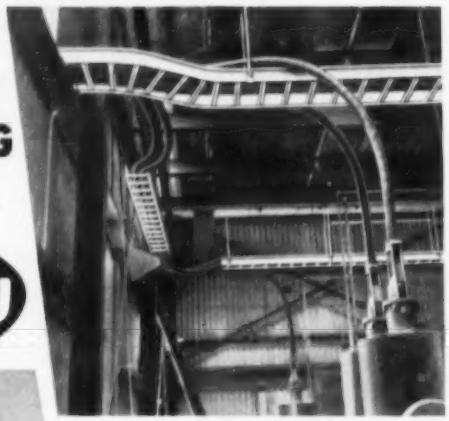

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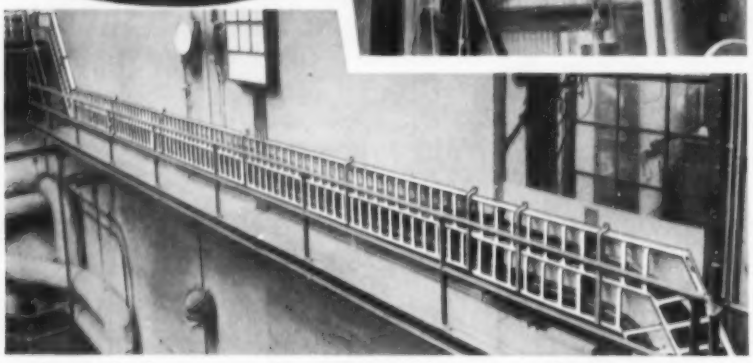

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Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

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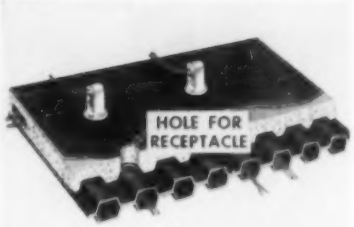
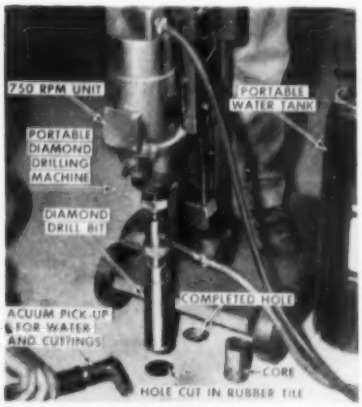


TYPICAL FLOOR SECTION showing cells of steel subfloor used for wiring. Access holes through concrete cap to cells for receptacles were drilled after rubber tile was added to floor area.



DIAMOND DRILLING UNIT met rigid job conditions on this project. Core bit with water swivel attachment cut smooth, clean, dust-free, holes in 1½ to 2½ minutes. Vacuum pickup sucked water and cuttings out of openings.

pendorf, and job superintendent "Ping" Confletti analyzed all facets of problem. They immediately ruled out pneumatic or electric impact hammers as being too noisy, too dusty and too hazardous from the standpoint of possible damage to surrounding floor and tile area.

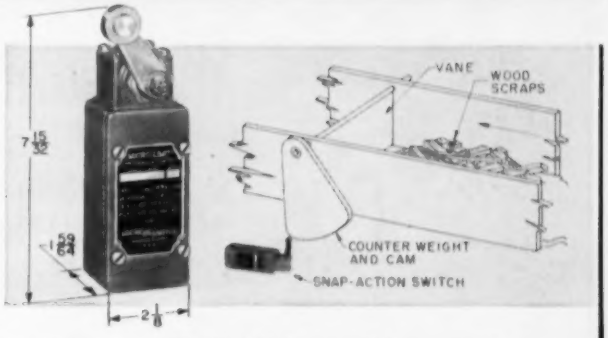
The obvious solution was some form of rotary drilling equipment that would cut a smooth core out of the slab to provide access to the steel floor cell. Such equipment had to meet some rather rigid job conditions. It had to be portable; quiet, clean and dust-free in operation. It had to do the job quickly and be so designed that moving it from office to office would not mar the rubber tile floors.

After carefully studying available drilling techniques and equipment, the Harlan team chose a Truco portable diamond drilling machine as coming closest to meeting the requirements of this project. The base of the drill stand had rubber-tired wheels to prevent marring the surface of the floor tile. The compact assembly was easy to move about. The drill motor, on its telescoping support-

MICRO SWITCH . . . FIRST IN PRECISION SWITCHING

MICRO SWITCH "ML" Switch is control limit to avoid conveyor jams

This conveyor system was designed to carry off wood scraps. A vane is constructed in the conveyor line so that material passing down the line presses against the vane in case of a jam-up. The vane is counterweighted by a sector cam made of heavy steel plate. When the lowering of the cam operates the "ML" switch, the conveyor line shuts down. The "ML" switch was selected because it is sealed against weather and permits a 60° overtravel.



MICRO SWITCH "ML" switches combine rugged construction with precise operation. Both single and two-circuit switching units are available. Electrical rating is 20 amperes 120, 240, 480 volts, ac ; ½ ampere 115 volts dc ; ¼ ampere 230 volts dc ; ¾ H.P. 110 volts ac ; 1½ H.P. 220 volts ac.

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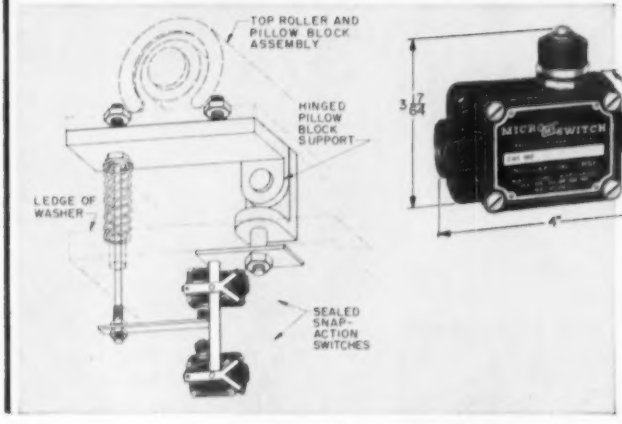

Tension kept within limits by spring lever working between two switches

Fabric tension in a bleaching and dyeing machine is kept from becoming too great or too slack by the use of two MICRO SWITCH "F" switches. The switches are positioned to stop the machine in the event the material passing through the top roller becomes too tight or too loose. Slackening of the cloth brings the lever against the upper switch. Excessive tension releases the springs and the bottom switch is actuated. The Type "F" switches were selected because of their dependability and their sealed protection against moisture and dirt.

MICRO SWITCH "F" switches are long-lived precision switches with the capacity for making and breaking steady state currents of 20 amperes and switching inrush currents as high as 75 amperes.

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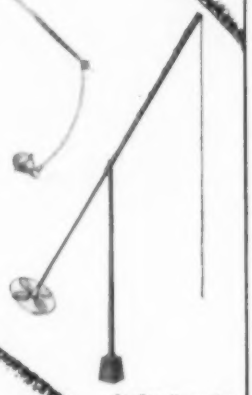

Cor-Ten Heavy Duty Pole will handle 180 lbs. of Floodlights

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ing post, could be swung to any angle for drilling. The diamond-tipped core bit cut fast, smoothly and quietly through the concrete slab and eliminated patching around inserts. A water attachment cooled the bit, eliminated drilling dust and flushed out cuttings. A vacuum attachment sucked out the water and cuttings, leaving a clean opening. All these advantages were proved as the job progressed.

The big payoff to both contractor and customer was the time element involved in drilling the openings. With the diamond drill unit, Harlan men were able to cut a 2½-in. diameter hole in the 3½-in. thick slab in about 1¼ to 2½ minutes per opening. This was roughly 10% of the time normally required by conventional methods.

On this project, an average of 140 holes were drilled with a single diamond-tipped bit. At this point, the drills maintained fair cutting action but were taken out of service to assure maximum salvage of the diamonds for resetting. When this procedure is followed, diamond-tipped drill salvage is high, asserts Karl J. Klapka, chief engineer and sales manager of Water Swivel Division, Wheel Trueing Tool Company, Detroit, manufacturers of the Truco units. Mr. Klapka points out that diamonds, when treated in this considerate manner, usually can be reset with one of their several cutting faces exposed for drilling. Bits with diamonds reset using this procedure are then ready for efficient reuse.

To expedite insert installation and maintain the streamlined construction pattern used on this building, Harlan's top field men developed a five-step sequence. (1). The insert locations were spotted and marked; (2) a holesaw was used to cut a disc out of the rubber tile at each location; (3) the diamond drill unit was used to cut a smooth core out of the concrete cap to reach the steel floor cells; (4) holes 1⅝-in. in diameter were drilled through the top of the steel cell; and (5) outlet fittings with self-tapping threaded bases were installed in each of the completed openings.

With this combination of power equipment and field organization, the Harlan team was able to install the 8,400 outlets in the 12 floors in a fraction of normal time and with minimum inconvenience to personnel being moved into the areas. The end result was mutually advantageous to both contractor and owner.

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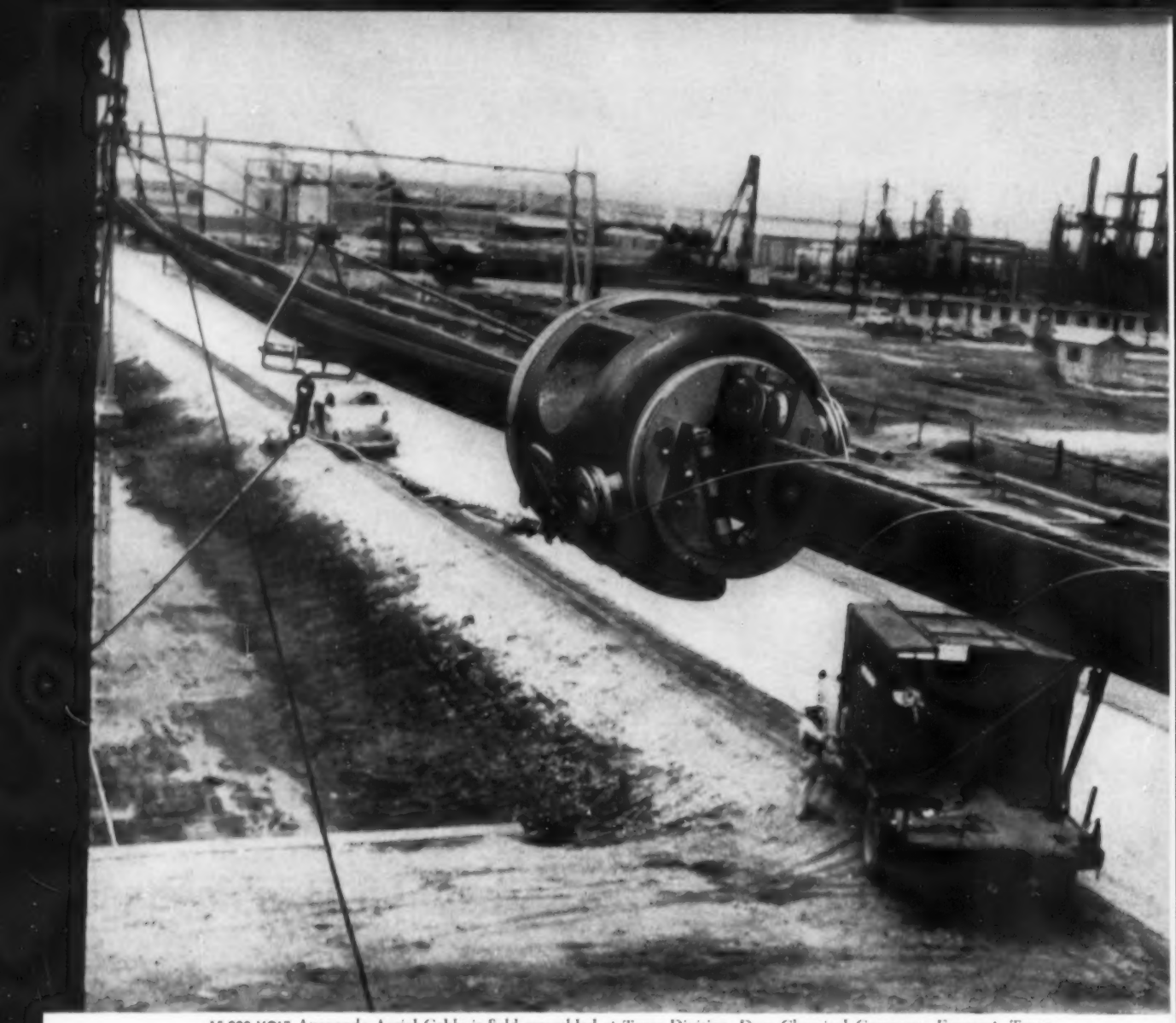

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In The News

America's First Nuclear Power Plant Goes "On The Line"

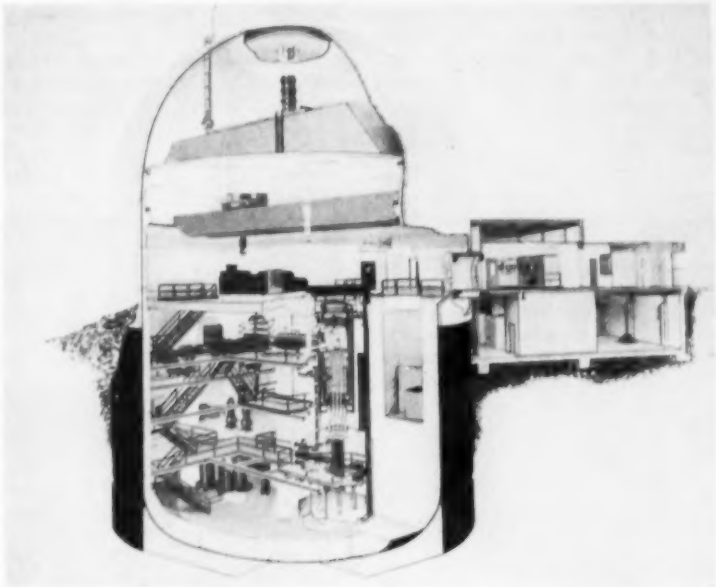
A new era in the commercial generation of electric power from nuclear fuels was initiated at 3:01 PM, Feb. 9, when Rep. Carl T. Durham (D., N. C.) chairman of the Joint Congressional Atomic Energy Committee, threw a switch connecting a 5,000-kilowatt generator of an Experimental Boiling Water Reactor (EBWR) to the power distribution lines at Argonne National Laboratory near Lamont, Ill. This is the first nuclear power plant to go into operation exclusively for the production of electric power, according to Adm. Lewis L. Strauss, chairman, U. S. Atomic Energy Commission, who introduced Rep. Durham at the dedication ceremonies.

EBWR is the first reactor to be completed in the Atomic Energy Commission's power reactor program. It is a direct-cycle boiling, 20,000-kilowatt (heat) reactor which provides the energy for generating the 5,000 kilowatts of electricity used at the Laboratory.

The reactor itself is a steel pressure vessel (23 ft long, 8 ft dia) of 2¾-in. wall thickness containing zirconium-clad uranium fuel elements, control rods and pure water. During the nuclear reaction, the fissioning of uranium atoms releases heat which converts part of the water in the core to steam. This steam, at 600 psig and 488°F is fed, through a steam dryer, to a turbine-generator set that differs from conventional units only in a few respects. The spent steam goes to a condenser and the resultant water is returned to the reactor pressure vessel. Circulation of cooling water through the core is by natural convection. The direct connection between reactor and turbine eliminates the need for costly heat exchangers. Reactor and turbine thus operate at the same low steam pressure.

The power plant—reactor, turbine-generator and associated equipment—is housed in a cylindrical steel tank (80 ft. dia., 119 ft. high) with elliptical top and bottom. About one-half of this gas-tight shell is below ground. The section above grade is insulated on the outside with three inches of foam glass with a mastic and glass fiber cloth coat. Access from the shell to the service building, housing the electrical controls and remote control equipment for the plant, is through double, interlocked doors providing an air-lock. The power plant building is ventilated, heated and air-conditioned by means of four package units. Outleakage of radio-active gases or dust in case of accident is prevented by automatic tight shut-off dampers in both air intake duct and

EXTERIOR VIEW of Experimental Boiling Water Reactor 5,000-kilowatt power plant at Argonne National Laboratory near Lemont, Illinois. Large dome is top of gas-tight shell housing the power plant. Service building with control board and switchgear is in front.



PERSPECTIVE OF EBWR power plant now producing 5,000 kilowatts of power for Argonne National Laboratory near Lemont, Illinois. Nuclear reactor, turbine-generator and associated equipment are in gas-tight shell at left; control board and switchgear are in service building at right.

exhaust stack. Dampers are actuated by radioactivity monitoring instruments. The plant control room in the service building is also air-conditioned.

Passage of electrical control cables from the service building to equipment inside the gas-tight power plant shell provided an interesting problem for Argonne personnel, Sargent & Lundy, Chicago, design engineers, and Gerson Electric Company, Chicago, electrical contractor making the installation for the Sumner Sollitt Company, Chicago general contractors. In general, cables were carried in metal troughs. Openings in the shell for power and control cables were plugged with suitable compounds to produce a gas-tight seal between the cable sheaths and the shell. Ends of cables were specially terminated to prevent leakage through interstices. This gave a complete seal between strands of the conductors, between individual conductors of a cable, between conductors and cable sheath, and between cable sheath and the shell. Coaxial and shielded instrumentation cables were terminated on both sides of the shell and circuits brought through by means of suitable gas-tight bulkhead connectors.

The size of the power plant was chosen specifically to achieve the purpose of the EBWR with optimum efficiency and economy. That is to experiment, study and demonstrate the practicality of direct-boiling power reactors. Plans are already being made to increase the output by experimenting with heavy water and forced circulation to produce data for use in the design of larger power reactors. In delivering rated power (5,000 kw) the present plant will use approximately 6 lbs. of nuclear fuel annually, compared to more than 4,000 tons of coal required by a conventional steam power plant.

Based on data already obtained from Argonne National Laboratory boiling water experiments, the Commonwealth Edison Company of Chicago, with a group of associated companies, is planning a boiling water reactor plant at Dresden, Illinois, to produce 180,000 kw of electricity. Another power reactor to produce 22,000 kw is planned by the Rural Cooperative Power Association for construction at Elk River, Minn. Northern States Power Company recently announced plans to build a boiling water reactor plant to serve the upper Mississippi area, site not yet chosen. General Electric is building a reactor, similar in many respects to the EBWR, at Valecito, Calif., to carry on its program of private industrial development.

Maintenance Show and Conference Attract 20,000 to Cleveland

The great importance of maintenance in all branches of industry was vividly emphasized last month when more than 20,000 representatives of companies in this plus 14 foreign nations converged upon Cleveland to attend the 8th annual Plant Maintenance Show. During this mammoth January 28-31 exhibition, 407 manufacturers displayed an estimated 8000 products collectively valued at approximately $5-million.

Concurrently presented during the first three days of the Show was the annual Maintenance Conference which this year attracted an attendance of over 2500 engineers and plant management personnel. With the theme of "Good Maintenance or Bad—The Difference Is Profit", the conference stressed such topics as changing requirements for maintenance; cost controls; materials handling equipment; equipment replacement; labor relations; preventive maintenance programs; maintenance shops; electrical distribution equipment; training and education of employees; welding; maintenance of electrical rotating equipment and controls; planning and scheduling; measuring effectiveness of work, and organizational problems in industrial plants. In all, 31 topics were discussed by and under the guidance of 62 recognized authorities on subjects so included.

In order to keep conference groups small enough to stimulate general discussion, as many as ten sessions were scheduled for parallel presentation during identical periods. However, in order to permit delegates to participate in as many discussions as possible, the majority of the sessions were repeated. Especially worthy of note is the fact that more than half of the papers presented at the Conference pertained either directly or in a general way to the electrical field; a significant occurrence in an all-inclusive across-the-board industry-wide Conference such as this one was.

As general chairman of the conference, L. C. Morrow (consulting editor, "Factory Management & Maintenance") stated that manufacturing companies would be expending 14% more for capital equipment in 1957 than they did in 1956 (a record amount up to that time). Since this capital equipment requires maintenance, this would reflect a correspondingly increased demand for maintenance effort. Furthermore, since an annual skilled-labor deficit of 150,000 workers already exists (difference between losses due to retirement, transfers and death, and replacements via immigration and training programs), this deficit has to be recruited from other sources. Maintenance is definitely affected by this shortage, he said, adding that qualified persons must be found, properly indoctrinated in modern methods, equipped with modern tools, then properly organized, supervised and rewarded. It is for that reason that these conferences were inaugurated.

ELECTRICAL ENGINEER M. E. Doolittle from the American Brass plant in Waterbury, Conn. (center) shared maintenance experiences with R. H. Bernstein, New Haven Board and Carton Co., New Haven, Conn. (L) and John H. Epperson from Monsanto Chemical's plant in Saint Louis, Mo., between technical forums of the 1957 Plant Maintenance Conference.

"Despite the size of the job, the lack of enough people to do it and the fact that we are not doing it as well as we should, I am not discouraged", he concluded, "for I recall conditions as they were just eight years ago when maintenance had no standing with management and very little self confidence. At that time there was no place to go except up. Today it *is* up but it can and must go further."

One of the most practical discussions from an electrical delegate's viewpoint was that presented by H. E. Heddesheimer, electrical engineering consultant for plant engineering and maintenance services at General Electric's Schenectady plant. Speaking on "Main-

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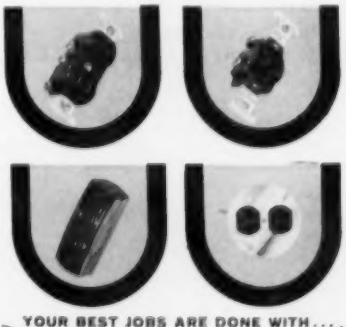

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taining Electrical Distribution Equipment", he stated that in today's highly motorized plants, a power outage of even an insignificant feeder can disrupt not only the production-line manufacturing processes but office procedures as well. "Production managers must assume that the power supply be continuous," he said, "because they already have enough problems trying to keep mechanical parts of the machines functioning properly. This leaves our plants with hundreds of thousands of dollars worth of highly specialized equipment that can give a reasonable return on investment only if it is run at top speed continuously."

Another discussion slanted directly towards electrical maintenance delegates concerned the "Maintenance of Electrical Rotating Equipment and Controls". This talk, by Arthur E. Goodwin of Westinghouse Electric's motor and control division in Buffalo, emphasized that the upkeep of most electrical apparatus is generally affected by wear of components or mechanical failure resulting from vibration (mechanical or insulation), dirt (and conducting dust), moisture (water, alkaline and acid), insulation weakness, lubrication (both excessive and insufficient), and misapplication of equipment. After discussing new materials and methods being used by rotating equipment manufacturers to facilitate or minimize maintenance, he enumerated practical step-by-step procedures recommended for the maintenance of motors and generators, automatic and electronic controls, grounding mediums, relays and contactors.

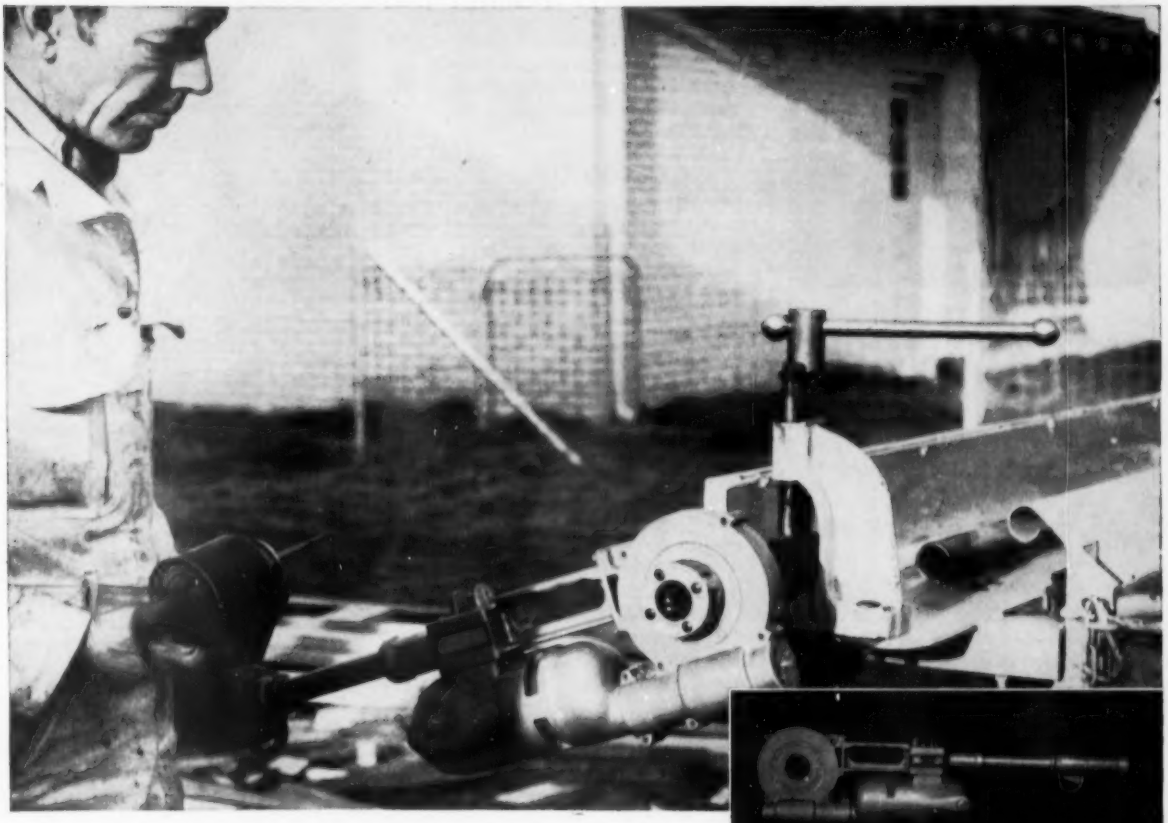
At the opening, and only general, session of the conference, O. S. York, manager, maintenance engineering section, E. I. duPont de Nemours & Co., stated that national industrial maintenance costs are mounting steadily, 1956 showing a 9% greater expenditure than 1955, and 1957 expected to exceed 1956 by at least another 10%. This would raise our total national maintenance figure above the $12-million mark. This figure should not be viewed with alarm, however, provided overall plant efficiencies are raised or downtime is reduced as a result of this gigantic investment in preventive service. Increased maintenance is quite understandable, he continued, particularly so since employment patterns are changing, technology in instruments and controls is advancing, new engineering materials are coming into being constantly,

MAINTENANCE ENGINEERS Walter T. Long and James J. Pinke from American Cyanamid's Pearl River, N. Y., plant were among 800 industrial representatives who sat in on four special Plant Maintenance Conference sessions devoted to maintenance of electrical distribution systems and rotating equipment.

manufacturing specifications demand greater precision, manufacturing is becoming more automatic and continuous and, as a result, maintenance is exerting a greater influence upon profits and returns on investments. This places greater responsibility upon the maintenance supervisor, for he must have (1) improved administrative controls to provide maximum organizational performance and optimum maintenance cost, (2) improved selection, training and upgrading of workers to provide the skills required to maintain the new equipment and processes, (3) improved tools and techniques to insure the most effective use of the skills developed in his maintenance force, and (4) improved preventive and corrective maintenance programs to reduce equipment outage to a minimum, insure continuity of operation and assure high quality and quantity production which are imperative to provide maximum profits.

Practical Data and Statistics

In presenting "A Case Report on Preventive Maintenance" at the Armco Steel Corp., Ashland, Ky., maintenance superintendent Fred M. Gross stated that in one department alone, unscheduled annual operational interruptions amounted to 438 hours prior to the adoption of a preventive inspection and repair program. The first year that an inspector was employed to detect and correct minor faults before they became serious, unscheduled interruptions dropped to 128 hours. Subsequent years saw these totals further minimized to 92, then 89, then 73. Since these temporary interruptions formerly idled many workers in this department, reduc-



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tion of down-time resulted in considerable product boost and improved manhour utilization. On the basis of this performance, inspectors were employed in other departments as well, with equal success.

Another discussion of general interest to electrical men concerned "Maintenance Cost Controls", which was presented by E. C. Newton from Atlantic Refining Company's Point Breeze plant in Philadelphia. Accurate evaluation of work to be scheduled is impossible when different methods are used to perform the same type of work, he said, adding that Atlantic has therefore developed a standard-practice manual which serves as a training guide for craftsmen and foremen alike. This manual is also used as the basis for upgrading craftsmen to better jobs, the lower ranks being refilled by processing new helpers.

Discussing problems related to "Maintenance Shops", A. R. Jones of the Norton Co., Worcester, Mass., stated that centralized service headquarters, even in very extensive plants, promoted greater cooperation between various trade groups, resulting in closer coordination and eliminating duplication of costly tools and equipment. Centralization also promotes more efficient use of transportation, for a fleet of trucks equipped with 2-way radios can be used to pick up men and material of all crafts. Trucks with hydraulic tailgates can be used for moving equipment in areas where no truck docks exist, he said, and smaller trucks or station wagons may be used for lighter assignments.

"Maintaining Handling Equipment" was the subject of a talk by John Bayuk, plant engineer of the Lycoming division of the Avco Mfg. Corp., Stratford, Conn. "The lifeline of any industrial plant is the flow of materials through processing from the rough state to finish product," he said, adding that any stoppage of this flow due to equipment breakdowns could completely stop production operations. This fact justifies a preventive maintenance program for industrial fork, platform and walkie trucks, roller and belt conveyors, overhead monorails, etc.

"Equipment Replacement Policies" were analyzed by R. I. Reul of the Food Machinery & Chemical Corp. in New York City, who emphasized the fact that the replacement of obsolete, inefficient or expensive-to-maintain equipment

QUARTETTE OF ELECTRICIANS from Thompson Products, Cleveland, including Bryon Bauer, Lou Grassel, Len Boehnlein and Nick Warholic, converged at "Electrical Construction & Maintenance" exhibit at 8th national Plant Maintenance Show which was held this year in Cleveland and attracted total of 24,000 industrial and commercial representatives.

can frequently be demonstrated to be more profitable and less risky than many other types of investment. In evaluating an investment, however, we should evaluate only the future, considering the past and present only as a baseline for comparison, he said. Investment data should be realistically complete, adding not only the cost of the equipment, but delivery and installation costs, engineering costs, monies required to purchase spare parts, special tools, operating supplies, production losses due to changeover down-time, etc.

Of special interest to executives of contracting companies was a discussion of "Labor Relations Where Union Labor is Employed" by Bert Walter, Clark Equipment Co., Buchanan, Mich. In this discussion he treated three general topics; first, prevalent areas of collective bargaining; second, how collective bargaining between companies and unions all over the nation affects the individual enterprise; and third, current trends of collective bargaining.

In discussing "Yardsticks by Which to Measure the Effectiveness of Maintenance", Captain R. S. Stewart, CEC, USN, Norfolk, Va., stressed the point that the purpose of maintenance is to reduce overall operating expenses, and that the total maintenance charge should include down-time losses as well as maintenance costs.

Ralph G. Smith, Dow Chemical Co., Midland, Mich., speaking about "Training and Education for Maintenance Personnel", stated that about 250,000 skilled workers in the U. S. either die, retire or are transferred to other jobs each year. To fill this void we are grad-

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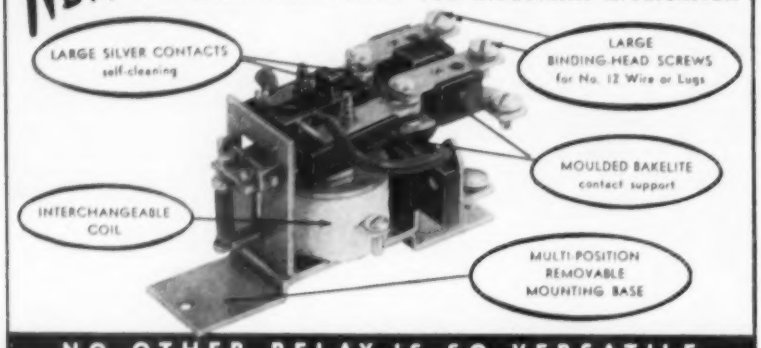
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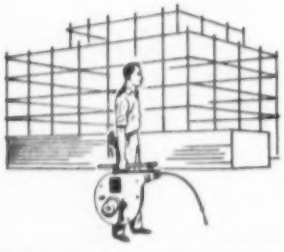

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uating about 70,000 apprentices, are up-grading about 15,000 more and are inheriting about 10,000 skilled immigrants. To fill the remaining gap, the government is directing attention to the further development of teaching staffs for technical institutes, increasing the number of students pursuing technical education, obtaining better utilization of technicians, obtaining greater public recognition for the technician's status, and granting greater financial support for the expansion of technical institutes. Labor can also cooperate, he continued, by allowing management more flexibility in the use of skilled manpower, working with company management to institute maintenance training programs, and urging employees to continue their local education.

"Maintenance in Small Plants" was the subject of W. C. Wallin, Western Electric Co., Inc., Winston-Salem, N. C., who mentioned that proper organization and direction of employees should be designed to reduce excessive clerical work, minimize travel time, promote versatility in crafts that are most important if down-time is to be minimized, and to provide close coordination between maintenance and production department.

This brief review of Conference discussions far from covers the wealth of practical material presented to and contributed by delegates, yet it does stress the widespread recognition which is being focussed upon the maintenance field. As in former years, complete Conference discussions, including all questions and answers brought out during the many sessions, will be available in book form later in the years from Conference managers Clapp & Poliak, New York.

IAEI to Foster Professional Status For Electrical Inspectors

High on the list of 1957 activities of the International Association of Electrical Inspectors is the establishment of a professional organization within the IAEI for electrical inspectors. This fostering of a professional electrical inspector status was revealed by IAEI secretary Charles L. Smith at the 27th annual meeting of the Illinois Chapter in Chicago.

An IAEI committee headed by Peter J. Hicks of Providence, R. I., is already exploring the idea. Fur-

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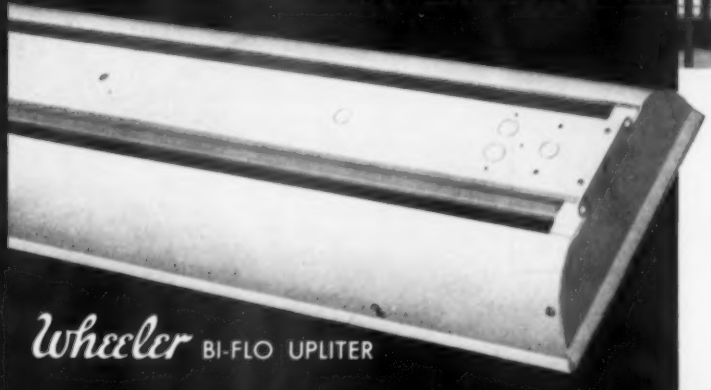

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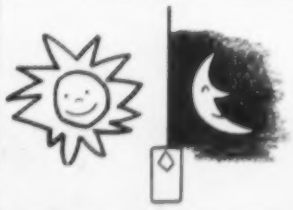

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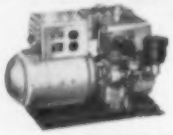

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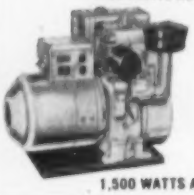

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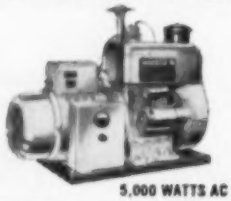

5,000 WATTS AC

10,000 WATTS AC

ther discussion of the possibilities of the proposed program will be a feature of the May meeting of the National Fire Protection Association in Los Angeles, Smith noted.

Prime goal of the proposed plan will be to accord the electrical inspector a professional status commensurate with his acknowledged important role in the electrical industry. To accomplish this, IAEI proposes a training program to increase the inspector's capacity; to teach him to think and reason in terms of electrical progress, instead of in terms of "antiquated laws and regulations"; to broaden his concept of his duty and responsibilities. Part of this may depend upon giving him standardized tools in the form of a uniform code and uniform code interpretations so he can intelligently interpret and apply code regulations and minimize costly equipment installation delays.

The growth and complexity of electrical system installations is demanding broad-base training of electrical inspectors. Electrical work specialization has progressed to such an extent that journeymen electrician training alone can no longer be considered qualification for an electrical inspector, Smith stated. An electrical inspector must be able to understand and pass judgment on all types of electrical equipment and installations. His broad knowledge must be backed by a high degree of technical skill, years of practical experience, and a diplomatic sales and counseling approach.

Details of the program and qualification requirements will be developed as blueprints if the proposed professional organization takes shape.

Mr. Ray Grahn, assistant building commissioner, City of Chicago, discussed the city building and electrical codes; told the assembled inspectors he is looking forward to the time when engineers dealing with public safety will be "professionalized". In his opinion, age should be no criterion of a man's usefulness.

The "price conscious" barrier to adequate and expanded wiring in new and existing homes must be hurdled, Kenneth Reeling, Northbrook, Supt., Public Service Division, Commonwealth Edison Co., told the group. Evidence that it is being cracked in the Chicago area rests in a report that some 200 builders constructed 15,000 homes last year (about one-third of all new homes built) with "100 Plus" wiring installations.

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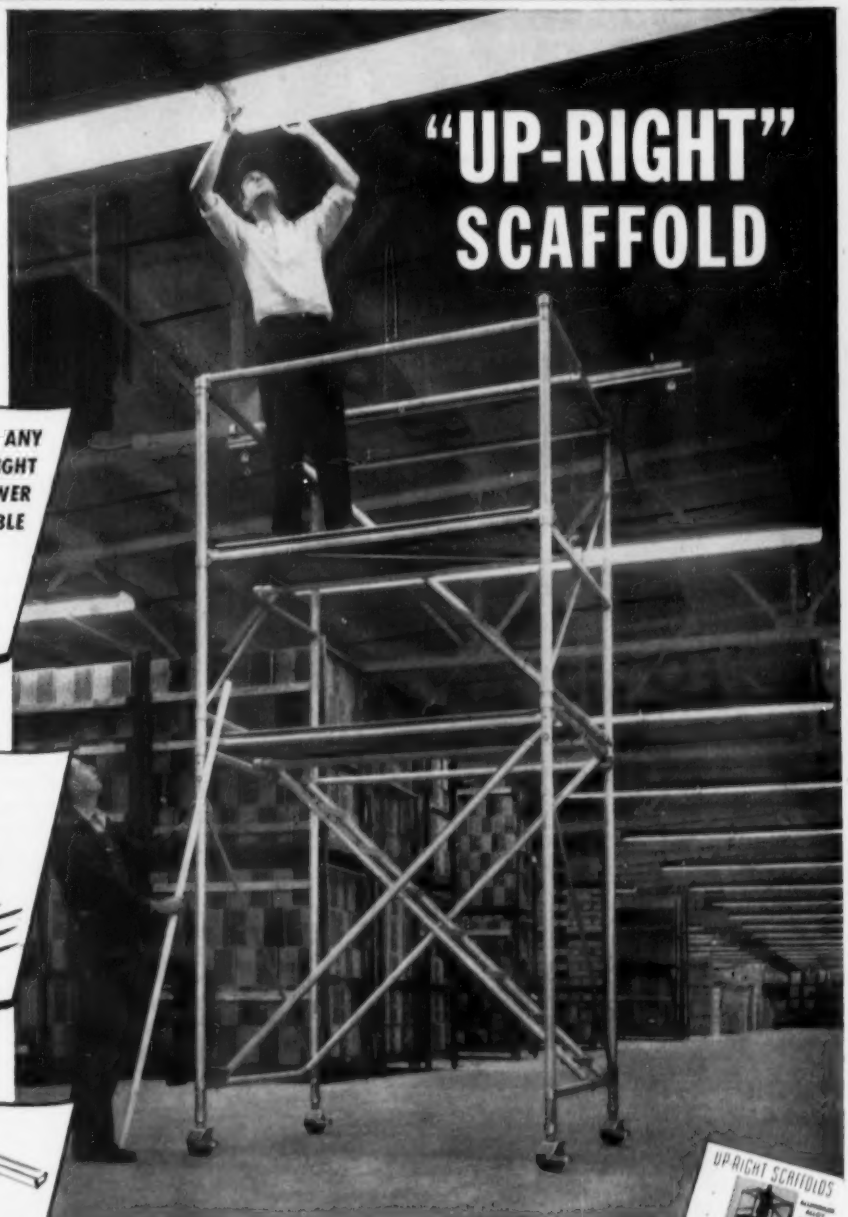

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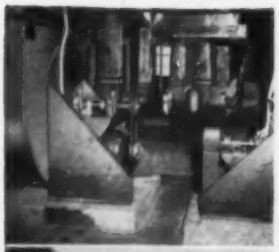

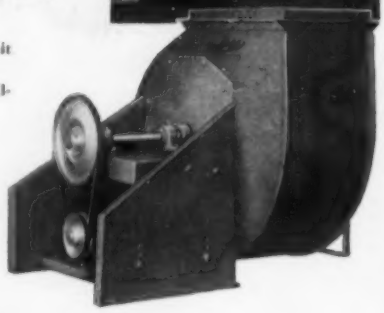

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CHAIRMAN of the Illinois Chapter, IAEI,. is James P. Corcoran (left), Mill Mutual Fire Prevention Bureau, Chicago. Retiring chairman Joseph M. Crosno, Bloomington, Ill., presents him with the gavel at the 27th annual meeting of the inspector group in Chicago.

C. C. Simpson, managing director, Electric Association, Chicago, gave an up-to-the-minute report on National Electrical Week plans for this year. A highly informative sound-film on laboratory testing techniques was shown by Norman Davis, Jr., executive engineer, Underwriters' Laboratories, Inc., Chicago.

The usual code interpretations forum at these meetings highlighted field problems of inspectors. One such spirited floor discussion led to the adoption of a conference resolution stating that "in the future all conductors of a size No. 14 and larger AWG be clearly and permanently marked with type of insulation and size of conductor . . . at intervals not to exceed six inches. . . ." The present code does not require indication of size.

James P. Corcoran, Mill Mutual Fire Prevention Bureau, Chicago, was elected chairman of the Illinois Chapter, IAEI. First, second and third vice-chairman are respectively: Cal Condon, Floosmoor, Ill.; Don E. Coutts, Chicago; and Lyle E. Dunham, Springfield, Ill. Clarence A. Wingfield, Chicago, was re-elected secretary-treasurer of the Chapter. Members of the Executive Committee are as follows: chairman, Wm. P. Hogan, Jr., chief electrical inspector, City of Chicago; Henry Czech, managing director, Midwest Electrical Distributors Association, Chicago; A. A. Sommer, Bussmann Mfg. Co, Chicago; Henry Kropp, Rightway Electric Construction Co., Chicago; J. E. Turek, Suburban Division, Berwyn, Ill.; and J. M. Crosno, Bloomington, Ill., past-chairman.

The next meeting of the Illinois Chapter is tentatively scheduled for May or June, 1957, at the Hotel Custer, Galesburg, Ill.

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Ans.—Cover-all spacer, an integral part of Anderson's U-Bolt Connectors.

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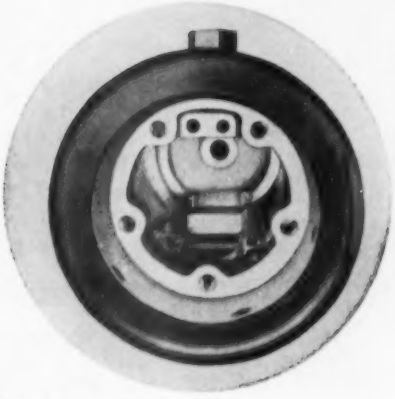
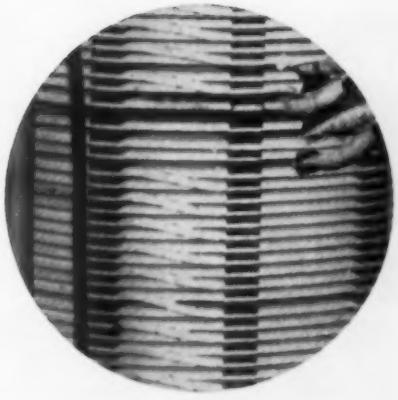


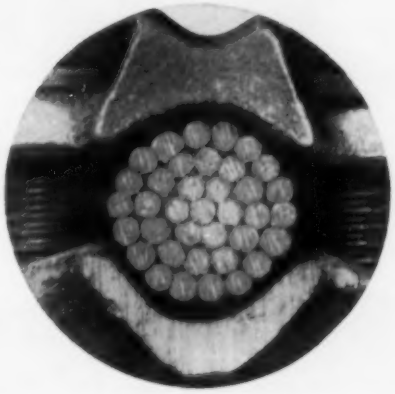
2. This breaks the current!

Ans.—A look inside the interrupter tube.



3. This carries the load!

Ans.—Coil assembly of oil immersed transformer.



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Marcus Heads Motor Shop Group

Abe Marcus, Ther Electric & Machinery Co., Chicago, is the new president of the Electric Motor and Service Association (Central District Chapter, NISA) in Chicago. Other officers serving with Marcus for the 1957 term are: vice-president—Bernard Ferrari, Jr., Excel Electric Service Co.; secretary—W. C. Luebker, Hyre Electric Co.; treasurer—Leroy Nettgen, Wagner Electric Company.

The EMSA Board of Directors has the following roster: H. W. Reeve, Inland Industrial Electric Service Co.; Sigmund Pluskota, Pluskota Electric Co.; M. R. Steck, Roberts-Stage Electric Co.; W. J. Billings, Ebling Electric Co.; Clarence Sievert, Sievert Electric Co.; and Fred Westphal, Westphal & Company Inc.

Veldhouse Is New CCECA President

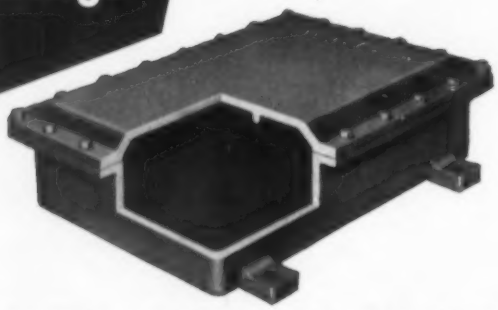
William Veldhouse, Service Electric Company, Chicago, is the newly elected president of the Cook County Electrical Contractors Association with headquarters in Chicago. Others chosen for executive positions in the association are: vice-president—G. A. Rafel, G. A. Rafel & Co.; secretary—A. L. Simons, Clark Electric Co.; treasurer—Erwin Kaufmann, Kaufmann Electric Company.

Serving on the Board of Directors are: J. N. Kunst, Jr., Principle Electric Co.; Carl W. Sievert, Sievert Electric Co.; Irwin S. Marks, D D Electric Co.; V. D. Signorile, Falson Electric Co.; W. J. Templeman, Premier Electri-

NEW PRESIDENT of the Cook County Electrical Contractors Association, Chicago, is William Veldhouse (right) of Service Electric Company, Chicago. Here, at installation dinner, he receives official gavel from retiring president Louis Matson of Active Electric Co. Chicago.

Explosion-proof Housings

cast aluminum



Non-sparking cast aluminum, strong and rustless. Available in a wide range of standard and special sizes.

Lightweight, easily mounts onto equipment. Drilled and tapped to specifications. Made to Underwriters and Military Specifications.

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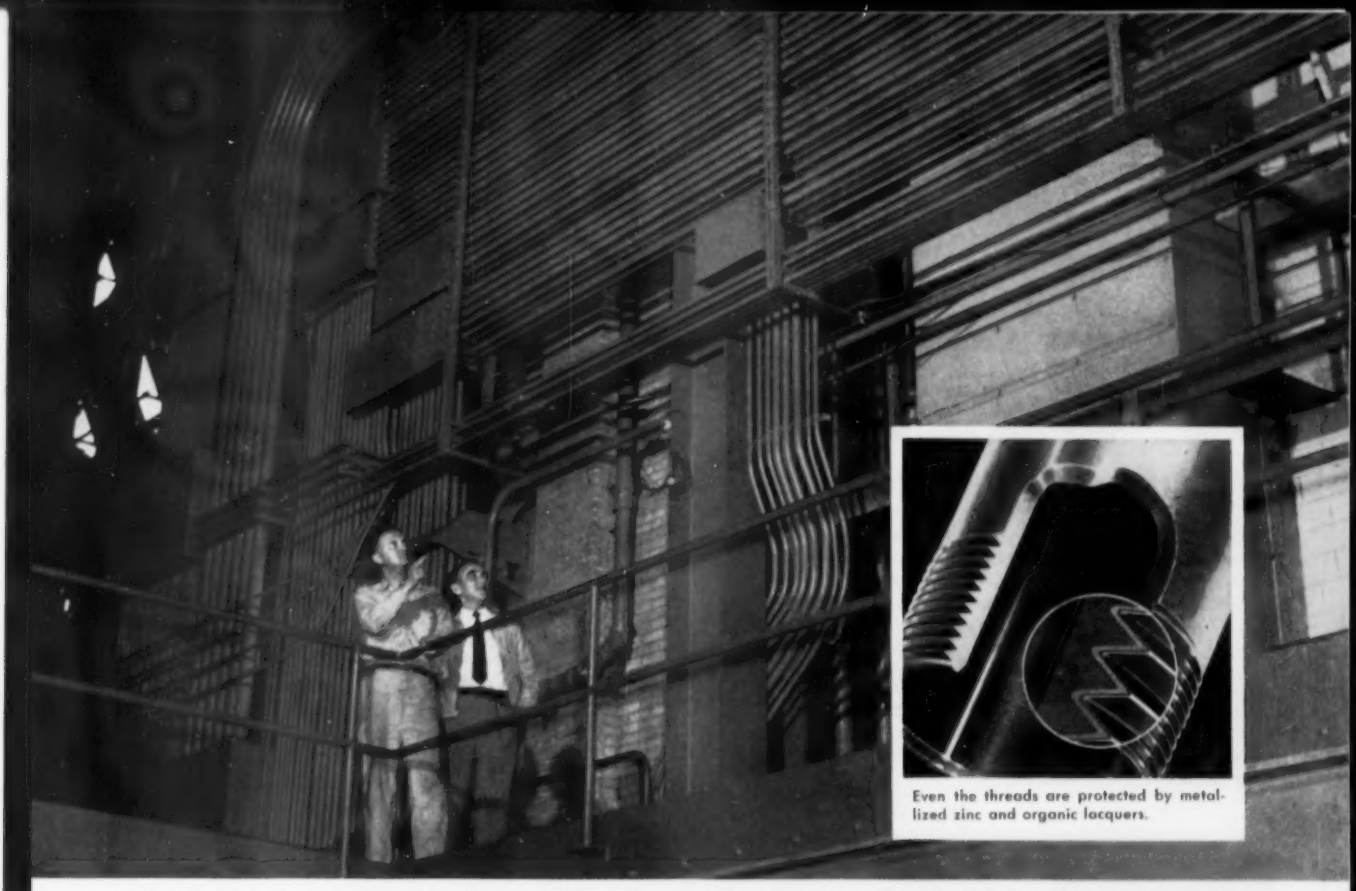

Even the threads are protected by metallized zinc and organic lacquers.

At the New York City Transit Authority's 74th Street Power Station, Milton W. Leslie, left (General Foreman, Hatzel & Buehler) discusses the rigid conduit installation with Louis Margolis, right (Hatzel & Buehler Project Engineer). More than 30,000 feet of rigid steel conduit were used on the south wall of the turbine house alone. A portion of the installation is shown here.

G-E WHITE rigid conduit makes the job easier in one of the nation's largest conduit installations

Included among the many products used in the $45,000,000 expansion program at the New York City Transit Authority's 74th Street Power Station are more than ½-million pounds of G-E White, the rigid steel conduit that has proved a time-saver on wiring jobs throughout the world. Wherever used, G-E White provides electrical contractors with the same benefits—easy bending, easy wire pulling, zinc-protected threads, superior corrosion resistance.

A Difficult Engineering Job

Severe space limitations made the modernization program at the 74th Street Power Station a difficult engineering job, creating special problems for the layout and installation of conduit. Numerous elbows and offsets stressed the importance of easy wire pulling, bending and threading. Moreover, the conduit had to resist the corrosive effects of high temperature and humidity.

G-E White meets all these requirements. All sizes bend uniformly without flattening. A special, anti-friction interior coating makes wire-pulling easy. The exterior is zinc-galvanized by metallizing, a process which bonds a pure zinc coating to the entire surface —including threads. Both inside and outside surfaces resist corrosion from heat, humidity, smoke, acid fumes and alkalies. Specify G-E White when you're selecting rigid steel conduit. It can help you do a better job more profitably.

Electrical contractor, on the work shown at the 74th Street Power Station, is the Hatzel & Buehler Electric Company, New York City. Design and supervision of construction is being performed by The J. G. White Engineering Corporation, New York City.

For more information on G-E White, see your G-E Construction Materials distributor or write to Section C57-318, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

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quick answers
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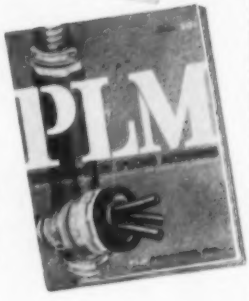
• No need for detailed designing, specifying and ordering of materials for cable joints! PLM provides quick answers in PLM Unit Package Splicing Kits, complete with casings for 2, 3 or 4-way joints, all materials needed, and detailed installation instructions. You specify cable sizes and ratings, or order from new, 52-page PLM Catalog 301.

Casings supplied in cast aluminum or bronze, in ratings through 23 kv, for joints in or to armored cable. Other unit package splicing kits for non-metallic sheathed and lead-covered cable. Write for Catalog 301 or ask for prices on your needs.



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saves labor
cuts costs

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- Weighs only 68 lbs.
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- Up to 2" pipe, conduit and Bus Bar!
- Also EMT Copper Tubing when used with Universal Frame.

Make bends faster, better and easier with this versatile bender, right on the job, in any position on the floor, ceiling, or in a ditch. Pump and ram are separate units. Motorized pump available.

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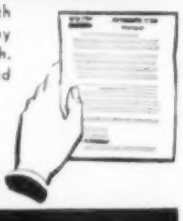
LEARN how this bender will reduce your material and labor costs.



TAL BENDING EQUIPMENT, Inc.
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cal Construction Co.; Abe Sluis, Sluis Electric Co.; H. W. Maynes, M G Electric Service Co.; and retiring president Louis Matson, Active Electric Company.

Chicago Contractors Re-elect Leasure

The Electrical Contractors Association of the City of Chicago (Chicago Chapter, NECA) unanimously re-elected Elmer E. Leasure, Monroe Electric Company, Chicago, for his ninth consecutive term as president of the group. He is also chairman of the Chapter Executive Committee and continues as a member of the NECA Board of Governors.

Jack W. Collins was reappointed Chapter Manager and serves as secretary-treasurer of the Association which has represented electrical contractor interests in Chicago for over 50 years.

Serving with Mr. Leasure on the Executive Committee are the following electrical contractors: Oliver F. Burnett, Jr., Kelso-Burnett Electric Co.; J. N. Pierce, Pierce Electric Co.; L. W. Johnson, Johnson Electric Co.; W. W. Giesen, Electrical Contractors, Inc.; C. P. Walters, Jr., Fries-Walters Company; W. J. Howe, J. Livingston & Company; T. L. Hankins, Condo Electric Co.; Fred Stocek, Hoffman Electric Co.; E. R. Hansen, Mead Electric Co., Inc.; C. A. Gall, Henry Newgard & Company; W. J. O'Brien, W. J. O'Brien Electric Co., Inc.

N. California Gives Lighting Clinics

The pay-off on the Certified Lighting Program comes from the promotional follow-up. CLP classes on selling and system design are only the beginning.

That's the conviction of the Northern California Electrical Bureau, which is now in midst of the second selling phase of its program. Taking advantage of the annual merchandising markets meeting in San Francisco, this industry-wide group is presenting lighting clinics aimed at store managers and buyers.

The clinics go beyond demonstrating the value of using the right light to display retail goods. They tie directly into CLP through

lists of local contractors who have taken the training course and who are nearby to help the retailer with his lighting problems.

The three main clinics were held this winter. From Jan. 6 to 9, one was held in conjunction with the Men's Apparel Club of California (CALMAC) meeting. The second came during the women's apparel sessions of the West Coast Salesmen's Association Jan. 13-16, and the third during the Western Merchandise Mart Feb. 4-8. The latter features furniture, housewares and appliances.

The tie-in with CLP is emphasized throughout the clinic by the speakers. Guest retailers are encouraged to utilize contractor graduates of the CLP training course. At the conclusion of each clinic session, the retailers are given lists of CLP-graduate contractors in various California towns. Registration lists from the clinics, moreover, are passed along to Pacific Gas & Electric Co. lighting specialists for followup through contractors.

The Southern California Electrical Bureau claims that it was among the first in the country to put CLP to work. Two courses, complemented by an advertising program slanted to industrial and commercial prospects, were offered in larger northern California cities.

When there was much demand for the course to be given in small cities, the bureau decided to set up a "traveling troupe" to take the school to the students. It was arranged to give the course in two concentrated meetings rather than in the customary six one-hour sessions, using two instructor teams in tandem.

The first team, starting out last Oct. 22, conducted sessions in four cities the first week, four more the second and five the third week. This team covered lamps, design, and the business potential.

A week later, the second team began to follow the same route. This team covered data application and how to sell good lighting.

The bureau says that, after the traveling school was complete, sales results followed immediately. In Merced alone, six jobs were reported underway the week after the course ended. In Salinas, four jobs were sold the next week and a total of 11 during the next month.

R&S *Announces ...*

A New Line of Explosion-Proof
300/500 Watt INTERCHANGEABLE TYPE
Pendent and Ceiling Lighting Fixtures
Class I, Groups C & D

Russell & Stoll has developed a new line of explosion-proof 300/500 watt lighting fixtures, designed to meet modern lighting conditions.

These new fixtures provide safe, efficient lighting for hazardous locations at moderate cost. Fixture construction is simple and truly explosion-proof, with heavy walls of high strength cast aluminum alloy. Lamp and wiring compartments are separate and individually explosion-proof.

Pendent and Ceiling Types

This new 500 watt Type EL fixture-globe-ceiling assembly will fit the standardized 100 to 300 watt pendent and ceiling bases interchangeably, providing for a flexible range of lighting levels from 100 to 500 watt whenever wattage changes are necessary to meet revised requirements.

Write for literature #51556-4

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NOW the industry's newest models.... at today's most inviting prices!

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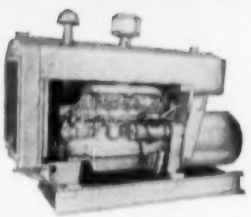
UNIVERSAL ELECTRIC POWER AND LIGHT PLANTS

New, low-cost, lightweight, air-cooled 3500 watt model.

New popular diesel model has 25,000 watt capacity.



New models . . . both gasoline and *diesel* series . . . fastest deliveries . . . sure to please prices—that sums up Universal Electric Power and Light Plants—the fastest growing line today!
Whatever you want in the broad 250 watt to 35 kw range, Universal has it. Models for emergency, intermittent or constant service — anywhere. Air-cooled types, water-cooled multi-cylinder models. All controls. All offering definite weight- and space-saving advantages. Get all the facts!

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Combination Motor Starters

Finest Products Engineered

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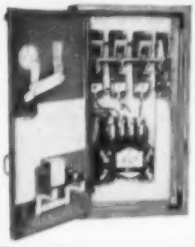
THERMAL MAGNETIC CIRCUIT BREAKER permits harmless temporary overloads; trips instantly when overload becomes dangerous... offers quick-make, quick-break action, thermal tripping element and deionization arc quenchers.



DISCONNECT SWITCH designed for cool operation, safety and long life. Features clear visibility, positive circuit opening and silver plated current carrying parts.

NOW Federal Pacific does away with the need for separate motor controls and safety switches or circuit breakers! Now you can meet all your needs with one simple space-saving device... and save money while you do it! You install only one device—save valuable time—conserve precious space! Faster, easier installation more than offsets the slightly additional cost.

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CONDUIT PIPE PRODUCTS CO., COLUMBUS, OHIO

SOLD ONLY THROUGH RECOGNIZED WHOLESALERS

NISA News

While getting ready for the NISA Convention, scheduled for Buffalo (Hotel Statler), May 12-16, the host Niagara Chapter, met on February 15 at Liederkrantz Club in Rochester. George Treiber, sales engineer of John C. Dolph Co. showed his firm's film "Dolphonizing Treatment."

• • • •

A new staff engineer, Charles (Hank) Lankford, has been appointed to the National Headquarters staff of NISA's St. Louis office. Mr. Lankford retired in 1954 from Century Electric Co. of St. Louis after nearly 40 years' service in small motor, integral and industrial sales. He was manager of the company's industrial sales for 20 years prior to his retirement. Mr. Lankford will serve the Association on a part-time basis.

• • • •

NISA's Puget Sound Chapter met February 5 at the Benjamin Franklin Hotel in Seattle. The group met for dinner and held a business meeting. John Julian of John Julian & Son Electric Motors, Renton, Wash. showed the group a special flange-mount oil burner motor adapter which he designed.

• • • •

Southwestern Chapter meets March 14-16 in San Antonio at the Hilton Hotel. John Phares of Southwest Electric Co., Oklahoma City, spoke on shop layout and "good housekeeping." A management forum and a film on epoxy resin applications by John C. Dolph Co. were also featured on the program of the two-day meeting.

• • • •

NISA president Charles J. Covington spoke to the Great Lakes Chapter at its February 18 meeting in Detroit. *NISA News* editor Horace Barks also appeared on the program. Another guest at the meeting was the new NISA assistant to the executive vice-president Joseph M. Harrington.

• • • •

Dave Gordon and C. E. Smith are the new president and vice-president respectively of J. E. Berger Corp., Detroit, having bought controlling interest in the firm from J. E. Berger, who has retired.

• • • •

$100 in prizes has been set aside by the New York Metropolitan Chapter of NISA for shop ideas. Entries must be submitted to Ralph Mollet, chairman of the awards committee before the chapter's foremen's meeting on March 23.

The chapter has issued a newsletter called "News and Chatter."

• • • •

The Greater Cleveland Chapter volunteered to furnish a continuing winding demonstration at the recent Plant Maintenance Show, January 28-31 at the Cleveland Public Auditorium. Lee Ruppersburg of Reserve Electric Co. was chairman of arrangements. The booth attracted considerable interest from the approximately 20,000 plant engineers and maintenance personnel who attended. NISA executive vice-president Fred. B. Wipperman, assistant Joseph M. Harrington and Horace Barks, editor of NISA News, also attended. Many NISA members from outside Cleveland were present at the show.

Shops participating in the winding exhibit at the Plant Maintenance Show included Reserve Electric, Elliott Electric and Motor Repair & Manufacturing Co., all of Cleveland, Commercial Electric Motor Repair of Cuyahoga Falls, Ohio, and Electrical & Mechanical Co. of Elyria, Ohio.

A NISA active member exhibiting one of its manufactured products at the Plant Maintenance Show in Cleveland was Industrial Engineering Equipment Co. of Davenport, Iowa. H. A. Pedersen, general manager of the firm, demonstrated the models of the "Hydraulic Pulley Puller" which the shop manufactures. Many NISA shops are doing limited manufacturing of this type, utilizing personnel's spare time and absorbing part of overhead costs. Excel Electric Co. of Chicago manufactures a ground detector. Wardell-Thurston of Buffalo is doing a small amount of manufacturing of rectifiers and electronic devices.

• • • •

The 1957 Buffalo Convention will see some innovations in standard NISA procedure. The Association's Board of Directors will meet Friday, May 11. Heretofore the directors have met on the Sunday which opens the Convention. This will be the final meeting for those members of the board whose terms expire. New members of the board, including Joseph Wagner of Wagner Electric, Philadelphia, and Ben Horton of Atkinson Armature Works, of Pittsburg, Kans. and reelected members H. C. Blenkhorn, Murphy Miller and Paul Sievert will join the other board members for a meeting after the Convention, on May 17.

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Cost-saving, on-the-job power anywhere, any time

Model 2.5M25, *2500 watts, 115 volt AC. Manual starting.*

Portable, low-cost Kohler electric plants cut work time. Save expense and delays of temporary power-line hookups. Operate floodlights, saws, drills, conduit cutters and threaders, other tools used for wiring jobs. Two-wheel, rubber-tired hand cart available. Sizes 500 watts to 35 KW. Stand-by models, 1000 watts to 50 KW, maintain home, public or commercial electrical equipment when central station power is off. Write for folder 9-E.

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Plumbing Fixtures • Heating Equipment • Electric Plants • Air-cooled Engines • Precision Controls

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Carry WATER, GAS AIR LINES, CABLE *at any angle to beams*

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On open steel construction. Efficiency "Type F" conduit Hangers are your best choice for carrying ½" to 2½" pipe and armored cable. Patented radiating ridges and 5-point gripping surface keep pipe and cables suspended dead center, permitting it to be carried securely at any angle to the beam.
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SEALS OIL IN . . . SEALS MOISTURE OUT . . .

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75KVA distribution transformer for pole or platform mounting.

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Use KEES adjustable OUTLET BOX HANGERS
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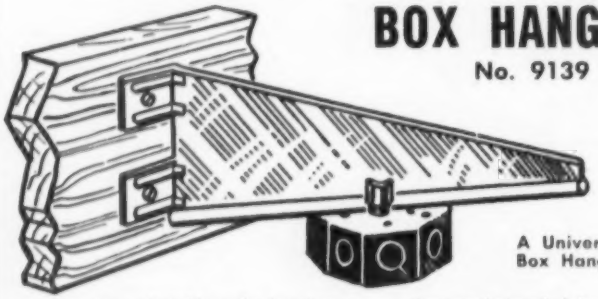

A Universal Box Hanger

Yes, Kees adjustable outlet box hangers are easier, and quicker, too! There's no need to notch the joist, for "offset" Kees hangers may be fastened to higher or lower side of joist. Box may be adjusted to any position from close to ten inches out from joist.

Can be used for mounting any type of box and fixture from any type ceiling using any wiring.

More easily installed than a bar hanger. Fastens to joist with 3 nails. Bracket is heavy pressed steel ten inches long. Three inches wide at nailing end. Rigid and amply strong. Lower edge is formed into tube on which the fixture-stud slides. Stud can be positioned exactly. Comes complete with fixture-stud and over-size notched locknut. (Outlet box not furnished.) Write for complete information.

Write P. O. Box 657 for Free Catalog

KEES

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DATES AHEAD

International Assn. of Electrical Inspectors—Iowa Chapter, Hotel Kirkwood, Des Moines, Iowa, March 21-22; Virginia Chapter, Nansemond Hotel, Norfolk, Va., April 8-9; Tennessee Chapter, Jackson Hotel, Nashville, Tenn., April 15-16; South Carolina Chapter, Columbia Hotel, Columbia, S. C., April 18-19; Florida Chapter, Washington Hotel, Jacksonville, Fla., May 3-4; Joint meeting Baton Rouge Chapter, George Welman Chapter, North Louisiana-East Texas Chapter, Texas Chapter, Texas Gulf Coast Chapter, Heidelberg Hotel, Baton Rouge, La., May 10-11; Ellis Cannady Chapter, Carolina Hotel, Raleigh, N. C., May 14-15.

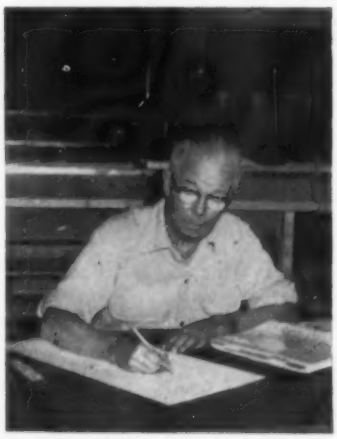
National Industrial Service Assn.—Foremen's meeting, Hotel Martinique, New York City, March 23.

American Power Conference—19th Annual Conference sponsored by Illinois Institute of Technology with 14 universities and 9 technical societies, Hotel Sherman, Chicago, Ill., March 27-29.

Illuminating Engineering Society—Regional Conferences: Pacific Northwest—Empress Hotel, Victoria, B. C., March 28-29; South Pacific Coast—Statler Hotel, Los Angeles, Calif., April 3-5; Inter-Mountain — Hilton Hotel, Albuquerque, N. M., April 11-12; Southwestern—Holiday Inn, Oklahoma City, Okla., April 28-30; Midwestern — Astor Hotel, Milwaukee, Wisc., May 9-10; Great Lakes—Pantlind Hotel, Grand Rapids, Mich., May 13-14; Canadian — Sheraton Brock Hotel, Niagara Falls, Ont., May 16-17; East Central — William Penn Hotel, Pittsburgh, Pa., May 23-24; Northeastern — Hotel Statler, New York, N. Y., June 12-13.

Edison Electric Institute—23rd Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., April 1-4.

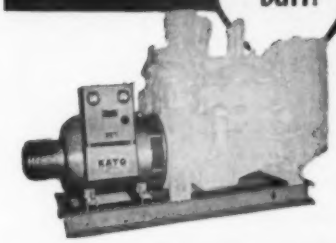
Fourth National Electrical Industries Show—Sponsored by Eastern Electrical Wholesalers Assn., 71st Regi-



ESTIMATING electrical work for Newbery Electric Co. of Los Angeles keeps chief estimator E. A. Patterson plenty busy in spite of many time-saving procedures and references which he has set up. He has had his entire department lighted with a luminous ceiling to provide quick and easy vision for all his engineers and estimators.

KATO GENERATORS . . . adaptable to all well-known engines!

FOR EMERGENCY AND CONTINUOUS DUTY!



CHOICE OF FIVE FLEXIBLE COUPLINGS
Adaptable to all engines with standard SAE BELL HOUSINGS

There is a size in the Kato line of generators with the electrical characteristics to meet your specific requirements. They hook up with any diesel or gasoline engine by means of one of Kato's flexible couplings. All standard frequencies . . . 25, 50, 60 and 400 cycles plus many special frequencies to 1200 cycles. (both fixed and variable). Now 400 cycles to 200 KW. 60 cycles to 500 KVA. One or two bearing design.

MOTOR GENERATOR SETS

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We Invite Your Inquiries Regarding Your Requirements

KATO *Engineering Company*

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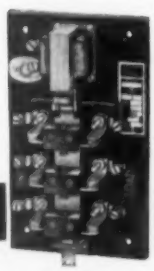
The finest MAGNETIC SOLENOID CONTACTORS are made by ZENITH



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- Simple design . . . rugged construction . . . finest materials.
- Simplified wiring.
- All parts easily accessible for service without disturbing other parts.
- Fine silver contacts . . . plus heavy compression springs . . . assure maximum conductivity.

Available in 1 to 5 pole, 25 and 50 amp. sizes. Other contactors, magnetically or mechanically held, up to 400 amps.

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DANA PRICE, the electrical engineering backbone of the firm of Golemon and Rolfe, Architects and Engineers, Houston, Texas, is shown here looking over plans of the Federal Reserve Bank of Houston, for which he designed complete high-frequency lighting as part of the electrical system.

ment Armory, New York City, April 8-11.

National Association of Lighting Maintenance Contractors—Fourth Annual Meeting, Hotel Muelebach, Kansas City, Mo., April 29-May 1.

National Industrial Service Assn. — Annual convention, Statler Hotel, Buffalo, N. Y., May 12-16.

National Association of Electrical Distributors—Annual convention, Sheraton-Park and Shoreham Hotels, Washington, D. C., May 26-29.

Edison Electric Institute—Annual convention, Palmer House, Chicago, Ill., June 3-6.

Chicago Electrical Industry Show—Conrad Hilton Hotel, Chicago, Ill., June 4-6.

New York State Association of Electrical Contractors and Dealers, Inc. —Annual convention, Saranac Inn, Saranac Inn, N. Y., June 30-July 7.

Illuminating Engineering Society — 51st Annual National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Technical Conference on Electrical Maintenance—King Edward Hotel, Toronto, Ont., Canada, September 27-28.

International Association of Electrical Leagues—Annual meeting, Sheraton-Gibson Hotel, Cincinnati, Ohio, October 2-5.

Electrical Progress Show — Commercial Museum, Philadelphia, Pa., October 7-9.

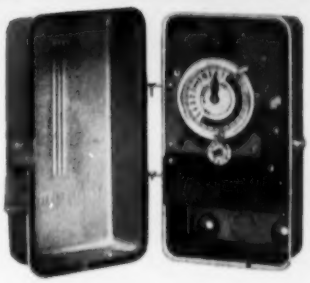
Rocky Mountain Electrical League—Annual convention, Broadmoor Hotel, Colorado Springs, Colo., October 13-17.

Florida Association of Electrical Contractors — Annual Convention and Electrical Trade Show, Soreno Hotel, St. Petersburg, Fla., October 16-19.

National Electrical Manufacturers Assn. — Annual convention, Traymore Hotel, Atlantic City, N. J., November 11-15.

National Electrical Contractors Association—Convention and Exposition, Netherland Plaza and Sheraton Plaza Hotels, Cincinnati, Ohio, November 11-16.

BUY RELIABILITY... HEAVY-DUTY GENERAL ELECTRIC TIME SWITCHES



Your best buy in heavy-duty time switches is the General Electric TSA-40. You get the dependability and long service life you require plus these outstanding features:

- Off-the-shelf delivery means you can get the TSA-40 ***when you need it.***
- More wiring space and removable cover simplify installation and maintenance.
- Completely weatherproof case gives protection in all climates.
- Extended temperature range allows operation in temperatures from −50 to 150°F.
- Exclusive contact shearing action breaks welds and keeps contacts clean.
- One-piece contacts and terminals eliminate internal load wiring that can burn out.

Contact your local G-E time switch distributor or send for free bulletin today!

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Outserve! Outlast!

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WHAT'S THE LAW?

By Jack and Michael Strauss

QUESTION: If an electrical contractor signs a contract and then discovers an error in his bid, can he demand more money?

Mr. Watts submitted a bid for the electrical work to be done at a county hospital. When the bids were opened, he was amazed to find his bid was lower than any other by $10,000.

"I knew it was low," pondered the perplexed electrical contractor, "but how could it have been so far out of line?"

Checking his work sheets, Mr. Watts soon came up with the answer. An illusive misplaced decimal point was to blame. Immediately, he notified the county of the error. Three days later, his bid was accepted as originally stated, and after signing a formal contract, Mr. Watts began to work.

When the job was nearly completed, Mr. Watts mentioned the error again and suggested that he thought it was a good time to adjust the contract price. The answer shocked the electrical contractor. He was told that the county never considered nor would it consider paying him more.

Losing no time, Mr. Watts made a bee-line for court.

"The county knew about the misplaced decimal point," he told the judge. "By asking me to sign the contract, it was certainly understood that an adjustment in the contract price would have to be made. I demand that the contract price be upped so that the contract clearly states what we intended."

THIS WAS THE DECISION: Mr. Watts was turned down. The court said while the misplaced decimal point would have justified the recalling of his bid, Mr. Watts could not ask that his contract be "reformed" since, knowing of the error, he nevertheless signed it and proceeded to do the work. What is more, the court added, while the purpose of "reformation" is to make a written contract truly express the intentions of the parties, there is no evidence that the county ever intended or agreed to pay an amount greater than that designated in the contract.

(Based upon a 1956 California Decision. State laws vary. For personal guidance, see your local attorney.)

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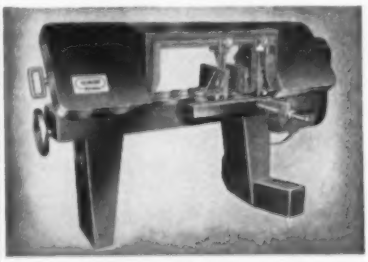

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Among the Manufacturers

Headquarters Announcements

National Electric Products Corp., Pittsburgh, Pa.—R. C. Bennett, Jr., general vice president; A. L. Robinson, Jr., coordinator of operations; L. D. Shank, general sales manager.

Westinghouse Electric Corp., East Pittsburgh, Pa.—Organization changes: East Pittsburgh plant now East Pittsburgh Div.; transportation and generator division now Power Apparatus Group; switchgear division now Switchgear Apparatus Group.

Minnesota Mining & Manufacturing Co., Electric Products Division, St. Paul, Minn.—Russell E. Strawbridge, sales supervisor for maintenance and construction trades; Arnold L. Moe, production supervisor for electro-mechanical products.

Westinghouse Electric Corp., East Pittsburgh, Pa.—Three new assistant general managers, East Pittsburgh Div.: S. J. Merriman, in charge of component products, printing and publications; Landon Fuller, in charge of Switchgear Apparatus Group; P. C. Smith, in charge of Power Apparatus Group.

Westinghouse Electric Corp., East Pittsburgh Div., East Pittsburgh, Pa.—M. H. Hobbs, assistant to vice president; L. A. Kilgore, director of engineering; W. E. Eargle, director of manufacturing.

Sylvania Electric Products Inc., Lighting Division, Salem, Mass.—Lawrence P. Pleasants, product sales manager, industrial-commercial lamp sales; Robert E. Betts, manager of manufacturing services; Paul F. Cameron, manufacturing manager—special products; Adolph A. Weeks, plant manager, starter and coil plant in Waldboro, Me.; Alton C. Kendall, operations manager—fixtures, with headquarters in Wheeling, W. Va.

General Electric Co., Schenectady, N. Y.—G. P. Vest, manager of marketing, Medium Transformer Dept., Rome, Ga.; Charles J. Meloun, manager of engineering, Outdoor Lighting Dept., Hendersonville, N. C.; Laurence L. Hartdorn, manager of instrument transformer sales, Instrument Dept., West Lynn, Mass.; James A. Yunker, general manager, new Lightning Arrester and Cutout Section, Pittsfield, Mass.

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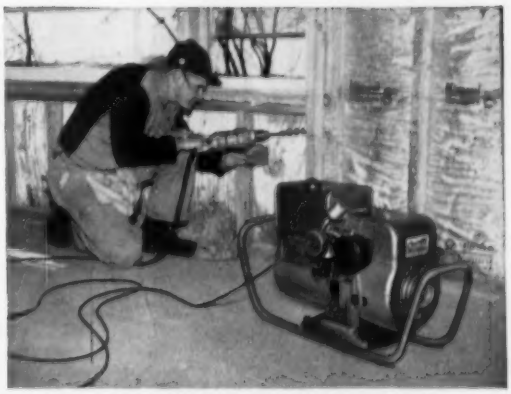

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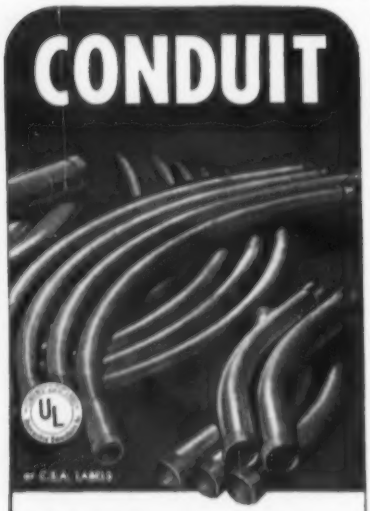

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Boyd S. Oberlink, elected to board of directors, in addition to duties as group vice president.

Westinghouse Electric Corp., Bloomfield, N. J.—Frank J. Camarata, manager of manufacturing, miniature lamp department; Philip F. Dietz, engineering manager, miniature lamp department; O. Bruce Goldsmith, manager of engineering, large lamp department; Raymond J. Stefany, incandescent lamp manager, commercial engineering section; Carl F. Jensen, manager of electroluminescent lighting.

Unistrut Products Co., Chicago, Ill.—George McKay, manager, electrical and mechanical construction division.

Sel Rex Corp., Newark, N. J., formed by merger of Sel-Rex Precious Metals, Inc., and Bart-Messing Corp., both of Belleville, N. J.

Gould-National Batteries, Trenton, N. J.—R. W. Hopewell, manager of field engineering, Industrial Div.

Cornish Wire Co., Inc., Williamstown, Mass.—Carl Edward Anderson, general manager.

General Electric Co., Bridgeport, Conn.—William L. Parkinson, manager of product service operations, housewares and radio receiver division.

Sylvania Electric Products Inc., Parts Div., Warren, Pa.—Merle W. Kremer, general manager; Richard E. Corcoran, product sales manager of wire and weld products.

Pittsburgh Reflector Co., Pittsburgh, Pa.—Ralph E. Smith, Jr., advertising manager.

Orangeburg Mfg. Co., Inc., Orangeburg, N. Y.—Richard F. Fagan, product manager, underfloor duct systems.

AMP Inc., Harrisburg, Pa.—Norman O. Olsen, product manager, Marine Div.; Joseph P. Flynn, product manager, new Public Utilities Div.

Lewis-Shepard Products Inc., Watertown, Mass.—G. Lincoln Ryther, sales promotion manager.

Air Reduction Co., Inc., New York—George E. Hawkins, executive vice president.

Electronic Communications, Inc., is new name of Air Associates, Inc., of Teterboro, N. J.

Hubbard and Co., Pittsburgh, Pa.—Raymond M. Waggoner, executive vice president; Howard Jackson, general manager of Chicago district manufacturing and sales operation in addition to duties

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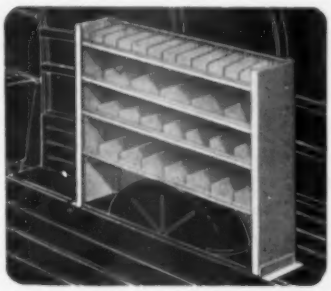

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as vice president in charge of production; L. T. Owen, general manager of Pacific Coast operations.

Pendleton Tool Industries, Inc., is new corporate name of Plomb Tool Co. Plants in Los Angeles and Jamestown, N. Y., will operate as Proto Tool Co. divisions.

John C. Virden Co., Cleveland, Ohio—C. R. Hosey and John W. Wade, vice presidents.

Auth Electric Co., Inc., Long Island City, N. Y.—J. Frederick Tuke, sales manager, Engineered Systems Div.; Munro Radford, sales manager, Equipment Div.; Sy Richman, advertising manager.

Production Instrument Co., Chicago, Ill., has been purchased by General Controls Co., Glendale, Calif.

American Gage and Machine Co., Chicago, Ill., has purchased Standard Transformer Co., Warren, Ohio. Standard Transformer Co. will operate as a separate unit with Chester F. Buckley president and general manager.

Kurt Versen Co., Englewood, N. J.—Richard C. Anisfield, vice president and national sales manager.

McGraw-Edison Co.—Charles Edison, chairman of the board; Max McGraw, president; Alfred Bersted, executive vice president; Henry G. Riter 3rd and Albert R. Jube, new directors.

Corning Glass Works, Corning, N. Y.—George W. Douglas, manager, lamp sales department, Electrical Products Div.; Frederick F. Fleischman, Jr., manager, lighting sales department, Technical Products Div.; R. Dale Sweigart, field sales manager, plant equipment sales department, Technical Products Dept.

Regional Appointments

MIDDLE ATLANTIC

General Electric's Silicone Products Dept.: George A. Darsie, Eastern District sales manager, headquarters in Newark, N. J.

FASCO Industries, Inc.: Clarke & Noce Inc., Pittsburgh, new representative in Pittsburgh area.

Wolverine Tube Div. of Calumet & Hecla, Inc.: John V. Betz, New York City, sales representative in New York area.

Femco, Inc.: John W. Bauer, sales manager, western Pennsylvania area; Addison Davidson, Jr., sales manager, eastern U. S.

General Electric's Construction Materials Div.: Peter L. Kenney and Henry A. Zarozny, district representatives, New York district.

Mitchell Mfg. Co.: John Riordan,

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FASCO Industries, Inc.: Meyer-Orens Co., Miami, Fla., sales representative for Florida area.

Marco Industries, Inc.: Joe E. Parker Co., Atlanta, Ga., southern sales representative.

Circle Wire & Cable Corp.: W. H. Lassiter Sales Co., Charlotte, N. C., sales representative for North and South Carolina.

Perfection Industries: Allison-Erwin Co., Charlotte, N. C., representative in North and South Carolina.

EAST CENTRAL

G. H. Leland, Inc.: K. R. Woolley, material manager, Dayton; T. G. DeMuesy, Eastern Regional manager, Dayton.

Thor Power Tool Co.: Martin A. Bertram, manager, new Great Lakes electric tool sales zone.

BullDog Electric Products Co.: Hugh R. Barth, midwest region Electrostrip sales engineer.

Femco, Inc.: John Taylor, district sales manager, Cleveland, Youngstown and Buffalo.

Mitchell Mfg. Co.: Karl J. Berliant, district sales representative in Northern Illinois, Chicago and Wisconsin.

Marco Industries, Inc.: Arthur A. Reed, Royal Oak, Mich., application engineer in state of Michigan.

Boston Woven Hose & Rubber Co.: Louis H. Champagne, Detroit, sales representative for friction, rubber and plastic tape in state of Michigan.

Wolverine Tube Div. of Calumet & Hecla, Inc.: William Bothwell, sales representative in Kentucky, Southern Indiana and surrounding area.

Graybar Electric Co.: S. A. Faren, manager, Grand Rapids, Mich., office and warehouse.

Wheelco Instruments Div., Barber-Colman Co.: LeRoy Peterson, branch sales manager, Springfield, Ill.; Harold Dirkers, branch manager, St. Louis, Mo.; Howard Berger, manager, Cleveland office.

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Mitchell Mfg. Co.: William J. Bagley, Missouri district sales representative, office in St. Louis.

Molly Corp.: G. E. Swanson, Stillwater, Minn., representative in Minnesota, Wisconsin, Iowa, North Dakota, and upper Michigan peninsula.

York Corp., Commercial Div.: J. W. Gerrard, St. Louis branch manager.

WEST

Graybar Electric Co.: R. G. Baker, operating manager, San Bernardino, Calif., operations.

Sprague Electric Co.: R. Elmore & Co., El Paso, Tex., representative for industrial power factor capacitors in Arizona; Ralph B. Black, Albuquerque, N. M., representative in New Mexico.

Femco, Inc.: Warren C. Sprague, district sales manager, west coast.

General Electric's Metallurgical Products Dept.: Paul Kunz, component sales representative in Texas area.

G. H. Leland, Inc.: George B. Isaacs, western district manager, Los Angeles; W. H. Moore, district office manager, Los Angeles.

Mitchell Mfg. Co.: George Lucas, district sales representative, Texas-Oklahoma area, office in Dallas.

Hexcel Products, Inc.: C. A. Peterson Co., general sales agents in Southern California, Southern Nevada, and Arizona.

Burndy Corp., Utility-Industrial Div.: Lawrence M. Lyons, Lynwood, Calif., western manager.

SOLUTION of a job problem is suggested by Axel Ornberg (left) to John Dollins, both of Curry Electric Co., Orlando, during recent annual convention of Florida Association of Electrical Contractors in Miami Beach.

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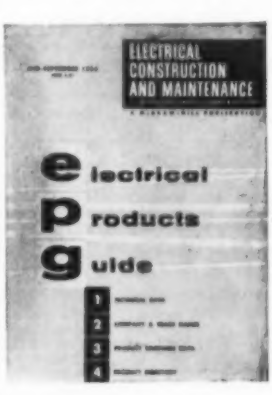

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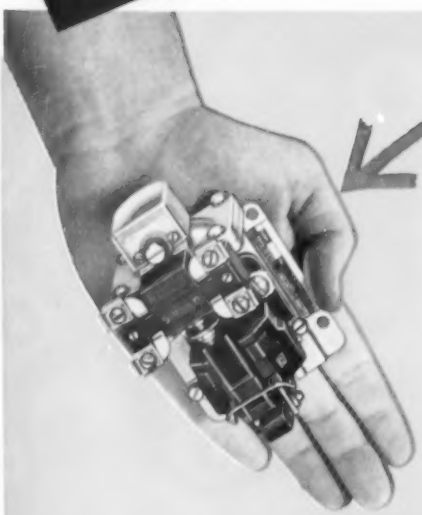

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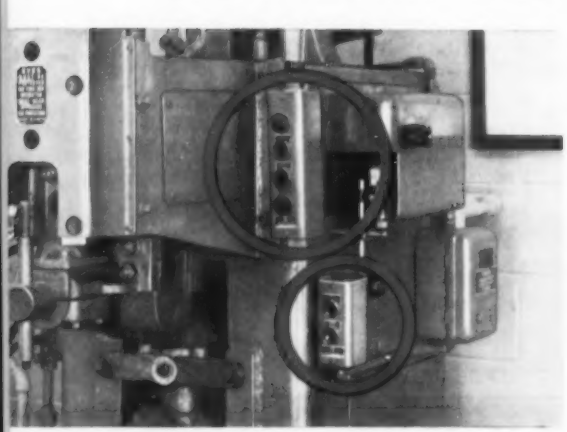

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